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MEDICAL AND SURGICAL REPORT
OF THE
PRESBYTERIAN HOSPITAL
IN THE
CITY OF NEW YORK

VOLUME III
JANUARY, 1898

EDITED BY

ANDREW J. MCCOSH, M.D.
WALTER B. JAMES, M.D.

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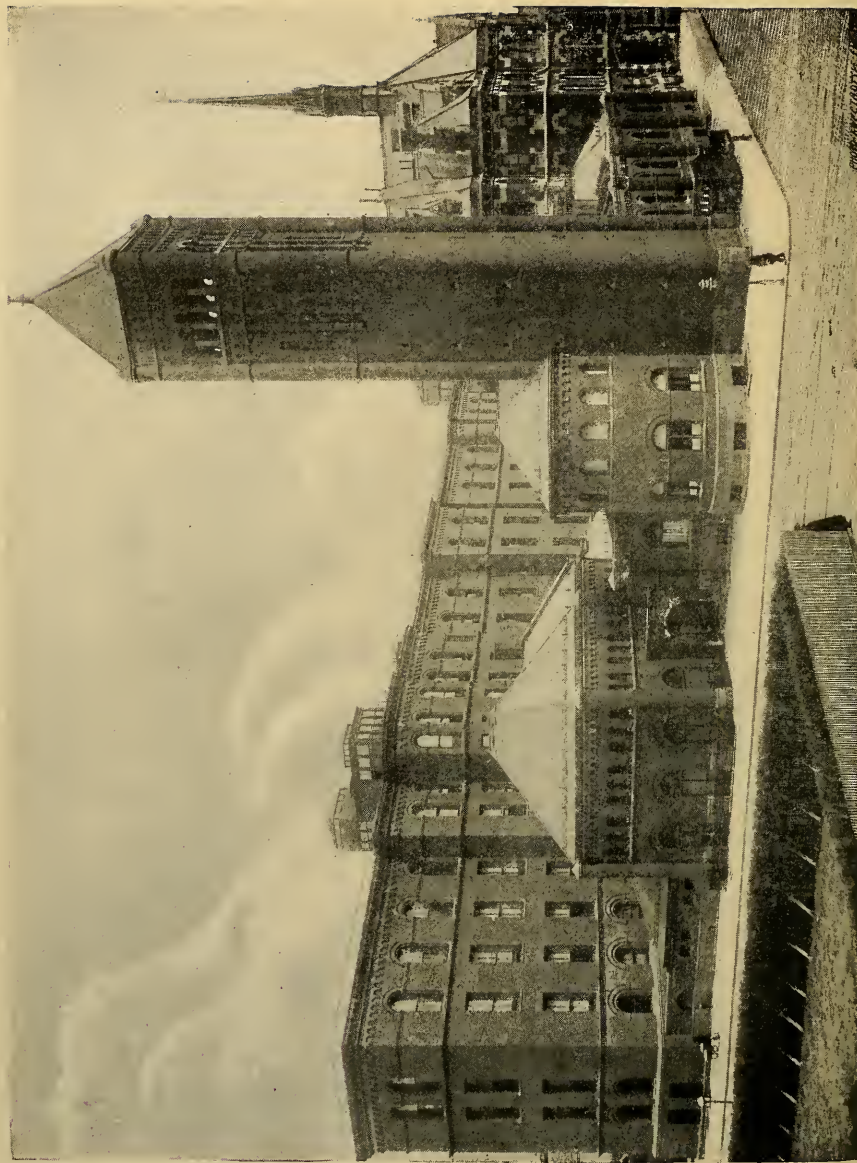
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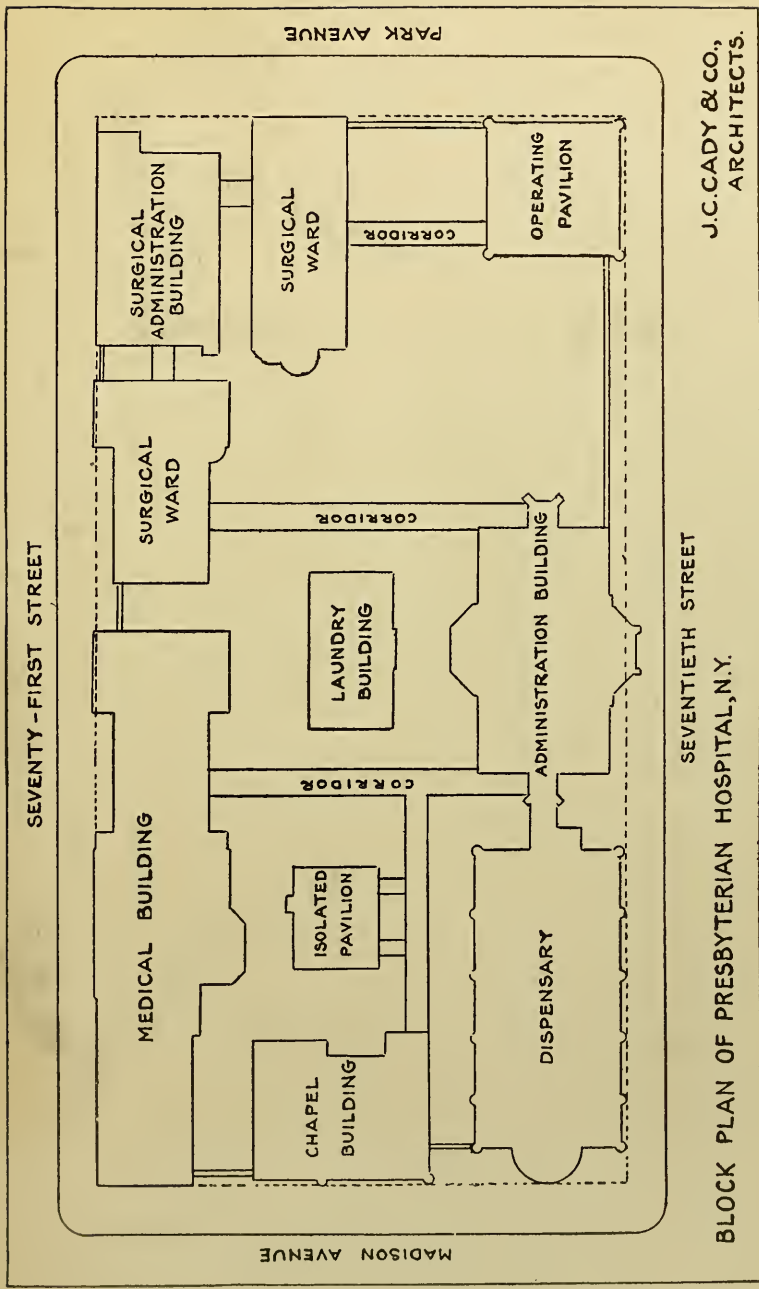


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GENERAL VIEW FROM THE WEST.



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OF THE
-PRESBYTERIAN HOSPITAL
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I.

ON SOME OF THE COLLATERAL FUNCTIONS OF A HOSPITAL.

BY WILLIAM H. DRAPER, M.D.

THE periodical publication of technical reports of hospital work may be said to constitute a more or less complete epitome of the progress of the healing art. It would be safe to assert that such reports, if they were everywhere recorded at the end of ten years, would be a faithful representation of the progress of our knowledge of disease and of the means adopted for the relief of every human ailment. This statement could not be made of the experience of any individual practitioner and the records of individual—independent of hospital—experience would be incomplete and comparatively of little value. The literature, therefore, which hospitals contribute to the knowledge of medicine and surgery, must always be the foundation and the measure of the science and art of healing. The appreciation of this fact has been recognized from the earliest times, but its value and significance are more strikingly illustrated in the last twenty-five years than ever before, for the reason that the results have been more exact and the increase of knowledge has been so vast.

This proposition, so familiar to the professional mind, deserves to be made for the better recognition of its truth by laymen, who are naturally much more interested in the results attained by the arts of medicine and surgery than in the means by which they have been achieved. It seems proper, therefore, to present with the publication of this Third Annual Report of the Presbyterian Hospital a few considerations concerning some of the commonly unrecognized functions of a hospital which may stimulate the interest that every human being should feel in institutions devoted to alleviating human suffering and prolonging and saving human life. It is especially desirable to suggest these considerations to those upon whose liberal

contributions the success of the work of the Presbyterian Hospital depends. The great mass of the people are interested in hospitals chiefly as places of shelter for the succor of the sick and injured. As some of them were administered in times past, they were often regarded with suspicion and even repugnance, but this feeling is rapidly giving way to one of confidence, even in the ignorant, who find, by experience, that this repugnance is not justified; there is still, however, a great lack of intelligent interest in hospitals, even among educated people, who regard them mainly from a humanitarian point of view as places to secure immediate and efficient relief for the sick and injured who cannot be cared for in their homes. This is perhaps more especially true of the sentiment toward great public hospitals for which the people are taxed. An obvious and practical benefit is the only thing that justifies the expenditure of public money, and the means by which such an end is accomplished cannot properly embrace a consideration of the ways in which public hospitals have led to the progress of the healing art, which has been brought about by modern discovery and the fruits of exact scientific methods. Hence it is, if you would find in this republican country the best examples of hospitals and hospital administration, the highest illustration of the achievements in the art of medicine and surgery, you must go to the hospitals which are founded and administered by private beneficence. A state of society, like our own, in which the administration of great human trusts is not entirely confided to government direction and control, and which goes on in any beneficent work which it undertakes independently of the public treasury, has certain advantages, as the history and present condition of hospital work in this country will abundantly show. It is safe to say that in hospital construction and administration, in all the details which contribute to the comfort and welfare of the patients, the hospitals of the new world, which have been created largely by private bounty alone, excel in every particular those of the old world, where they are created or endowed by the government. When we consider the number of patients cared for in hospitals in this country by institutions especially endowed or entirely supported by voluntary contributions, we shall find, I think, that it generally exceeds the number so cared for in other countries, and consequently that it bears a much larger proportion to the number cared for by federal, state, and municipal

taxation. This statement, of course, is not made upon statistical reports, but is, I believe, generally admitted. In comparing the institutions privately endowed and supported by voluntary contributions everywhere, and especially in England and in this country, with the public institutions maintained and administered by government authority and resources, we shall find the most striking difference in the excellence of their adaptation to their work, of the perfection of their equipment, and in their efficiency as measured by their results. The reasons for this difference are many, but the chief one, perhaps, is the fact that there is a more generous disposition on the part of intelligent people in this country to supplement the defects of government direction and control in purely humanitarian enterprises than in any other. Traditions and official regulations, which are often responsible for the perpetuation of faulty administration, are here more easily modified; we are less jealous of innovation and more ready to increase efficiency through the application of new methods.

Another reason why the hospitals in this country endowed and supported by private bounty have so far excelled in equipment and efficiency our public state and municipal institutions, is not only that they have more money to expend, but they usually have more intelligence in their boards of management in the spending of it. In a word, they are more in sympathy with all the benefits which the world has always derived from hospitals, and must always continue to derive from them. The managers of our well-endowed and liberally supported hospitals, while they are constantly concerned with the administration of immediate and efficient relief to the patients in the wards, are, at the same time, always interested in improving the means by which this is rendered more efficient and made more subservient to the progress of the healing art everywhere. As intelligent observers of the fact that all progress in medicine and surgery has been made in the fields afforded by hospitals and through the application of scientific researches and faithfully recorded clinical observations, they may be said to realize that a hospital is a *seat of learning* as much as any college or school of technology, and is really a part of a university system, inasmuch as its wards contain the material for elucidating the acquisition and illustrating the possibilities of the healing art. The appreciation of hospitals as the principal avenue through which progress is made in medicine and surgery,

and as furnishing the means of instruction through which knowledge is perpetuated and increased, has perhaps matured more slowly in the educated mind, in America than it has in Europe ; partly because the practical American spirit is more interested in results than in the means of attaining them, and partly because here there is a keener sense of the respect due to the person of the victim of physical suffering. For this reason, the managers of private hospitals in this country have restricted more or less the opportunities for teaching in the public wards. It is to be remembered, however, that in England many of the great hospitals have been the foundations of famous medical schools, showing that this feeling of repugnance to the exposure of the victims of disease and accident, as a means of instruction to the seeker after knowledge, is one which should not be encouraged, and is practically not justified. It is a matter of fact, indeed, that objection is rarely made by a patient to his being the subject of instruction to students and physicians ; on the contrary, he is rather pleased, and perhaps consoled, that a cruel fate has at least made him an object of interest and a text for useful precepts.

As schools of medicine, however, are constituted in this country, it is not possible to make our hospitals tributary, except in a secondary and indirect way, to medical instruction. There are a few medical schools, like those, for example, of the Johns Hopkins University and the University of Pennsylvania, which have hospitals attached to them, but in this city there is no school which has exclusive charge of a general hospital department for teaching clinical medicine. It is true that in several of our private hospitals much attention has been given to this object, and the large public hospitals have been wisely placed at the disposal of the medical schools in order that their clinical privileges may be utilized for instruction.

The efficient administration of a hospital, therefore, in these days, requires something more than good housekeeping and the regular performance of staff duties. It demands compliance with all the details of modern scientific medicine ; it requires laboratories for pathological research, and all the appliances necessary for precise observation and diagnosis and treatment of disease. As this has become necessary from a due regard to the needs of the patient so as to conform to the methods of modern medicine, it seems natural and proper that such methods should be made known for the benefit

of the largest number of workers in this special department of learning. As all this elaboration of means for securing the best results in the practice of the healing art has to be provided for every applicant for relief, it seems desirable that the hospital, in obedience to its high mission as a great public benefactor, should also point the way to every observer and student interested in its work.

In enumerating the means by which the hospital could thus be made to redound to the public advantage, the publication of annual reports must be regarded as an intelligent and important step in the right direction. The public, and especially the patrons and supporters of hospitals, ought to know the nature and success of the work that is done within their walls. An annual report reaches a wide circulation, and carries with it, to all parts of the country—of the world, we may say—a knowledge of the methods pursued in the treatment of disease. As has been said, the history of the medical art has for years demonstrated the value of hospital reports. They constitute the most valuable and enduring contribution to the science and art of healing which we have. To make these reports of value should be one of the especial aims of hospital administration. How to accomplish this purpose most effectively is yet to be learned. The labor involved in it is too considerable to be imposed upon the regular staff in addition to their present burdens, and the work of preparing valuable clinical records, in order to be thoroughly efficient and valuable, should be properly relegated to a separate officer. This, however, would add so largely to the expense of administration that it cannot at present be recommended. It is not too much to expect, however, that when the value of this extension of hospital work is justly appreciated, the money for its accomplishment will be forthcoming.

Next, as a means of increasing the usefulness of our hospitals to the public, must be mentioned the utilizing of them as schools of medicine for physicians and students. As we have stated, there is no school of medicine in this great metropolis which has a hospital attached to its equipment for teaching practical medicine and surgery, and no hospital which has actually become, or is likely to become, the nucleus, as in England and on the Continent, of a school of medicine. It has been suggested that some arrangement might be made whereby the several large hospitals in the city, private as well as public, should be confederated with the principal schools of

medicine, for the purpose of distributing in this way their clinical privileges. The time for such an arrangement, however, has not arrived, and with the present diverse school affiliations of the attending staffs in the large institutions, public and private, it is not likely to arrive. For the present the only course to pursue, in order to utilize the clinical privileges of the hospitals for the benefit of physicians and students, is for each hospital to do its work in this direction independently and in its own way. The managers of our large hospitals are alive, however, as they have never been before, to the importance of their institutions as schools of instruction, and to their duty as stewards of a great trust, and as citizens of a city which is destined to become one of the greatest, if not the greatest, centre of medical knowledge and instruction in the world.

There is no objection to the use of the wards of several of our large hospitals for teaching, by any member of the attending staff who aspires or desires to teach, and very valuable instruction is now freely furnished. We venture to suggest, however, that this privilege will be more largely accepted, and that hospital managers will be more assured of its advantage to the hospital and the public when, in course of time, no appointment shall be made to the attending staffs which does not carry with it the obligation as well as the commission to teach. Hospitals require for their administration a special class of highly trained men who shall represent the most advanced knowledge of the causes, effects, and treatment of disease. They are not only the class of men upon whom their institutions depend for their successful operation, but they are the class which it is an essential part of their duty to help to create. To be able to teach is one of the best tests of thorough knowledge, and one which it is proper and wise to demand of men seeking hospital positions. No higher motive than the desire to teach could exist; while the absence of such a desire might presume, if it did not indicate, a less worthy motive.

In connection with the educational functions of hospitals it is important to mention how largely the value of these institutions has been increased by an addition to their equipment which modern science has made essential to the early detection and accurate diagnosis of all infectious diseases. Within the last twenty years the so-called germ theory of disease has given an impetus to the knowledge of the causes of common and most destructive diseases,

and to the value of sanitary precautions in the management and control of them, which have compelled the adoption by physicians, boards of health, and especially hospitals, of systematic measures to prevent the spreading of these diseases. These measures require an expensive equipment in the way of apparatus and a staff of skilled assistants. Every large hospital now is provided with a pathological laboratory, which is of daily and imperative use in the hospitals, and which might be made, like the clinical privileges of these institutions, of great benefit to physicians and the public in securing the early recognition of infectious disease, not only in the hospital but in the practice of general practitioners, and as means of enlarging the teaching facilities and scientific work of the hospital. As the expense of maintaining pathological laboratories is considerable, it might be diminished by affording remunerative information to practitioners and valuable tuition to students.

In presenting these considerations concerning what we may call the secondary or collateral functions of a hospital as a seat of special learning and a school of medicine, we have desired to distinguish this function in such a way as not to interfere with the public idea of hospitals, which is based upon purely humanitarian motives, by showing that as an educational and civilizing force their humanitarian work is in a broader and more significant sense as apparent in what they accomplish for knowledge as it is in the works of mercy done in their wards.

II.

AN UNUSUAL CASE OF RECURRENT MULTIPLE NEURITIS OF UNCERTAIN CAUSATION WITH PARALYSIS OF THE PHRENIC NERVE—RECOVERY.

BY PROFESSOR M. ALLEN STARR, M.D., PH.D.,
CONSULTING NEUROLOGIST TO THE HOSPITAL.

CASES of multiple neuritis are not uncommon, and their diagnosis is not at all difficult. They are distinguished from cases of paralysis from spinal disease by their rapid onset, by the symmetry of the paralysis upon both sides of the body, by the great degree of paralysis in the distal parts of the extremities, when the proximal parts and the body may be unaffected, by the stocking and glove-shaped areas of anæsthesia of the extremities, and by the perfect preservation of the control of the bladder and rectum.

In cases due to alcoholism of long duration, which form the majority of the hospital cases, pain in the limbs of a very severe character, intense paræsthesia, and tenderness of the surface of the limbs are usually very marked characteristics. These patients usually show some mental symptoms of chronic alcoholism as well as the symptoms of neuritis; being distinctly weak in their memory of recent events, utterly unreliable in their statements; and being under the control of hallucinations and of delusions so that their mental disturbance is as striking a symptom of the disease as is the paralysis. In other forms of poisoning such mental disturbances are rarely observed, though they do occur as a result of plumbism.

In cases of paralysis from multiple neuritis developing subsequently to the acute infectious diseases, pain is not, as a rule, present; and though numbness may be felt and a varying degree of anæsthesia up to the elbows and knees is not uncommon, there is rarely any tenderness along the nerves, and handling the limbs does not cause pain. Ataxia in movement is very often observed either preceding or attending the paralysis in such cases.

It is only in the more severe cases of these two forms of the disease that any involvement of the cranial nerves is observed. And such involvement is justly regarded with apprehension by the physician, as it is well known that paralysis of the pneumogastric nerve is the cause of death in multiple neuritis in a considerable number of cases.

Disturbance of respiration from affection of the diaphragm is the rarest of all symptoms, and, like paralysis of the pneumogastric, has always been regarded as of the gravest prognostic significance. That it is not, however, always followed by death the following history demonstrates.

A. A. B., born in 1877, a young man of healthy parentage and of fine general physique, without any history of specific disease or of any bad habits, was sent into the Presbyterian Hospital on October 7, 1897, being then in a state of general motor and sensory paralysis involving all the limbs.

His first illness of any severity was a similar attack of general paralysis which occurred in 1892. In the summer of that year, while living a healthy out-of-door life, he noticed a clumsiness of his hands, a tendency to drop things, and a feeling of unusual fatigue in his legs, which was soon followed by inability to stand on his toes. These symptoms were not attended by pain or by any general constitutional disturbance. They increased, however, very rapidly to the point of absolute paralysis, and in three weeks after they were first noticed, he was unable to use his hands to feed himself, or to walk or to stand alone. His control of his bladder and rectum remained normal, and except for his muscular weakness and a sensation of numbness in his limbs, he felt well. He was sent for treatment to a sanitarium, where he remained for three months, but as he did not improve, he was then, in October, 1892, taken to St. Luke's Hospital, where he was examined by the late Dr. Walter Vought and by me. At that time he was found to have a total paralysis of all the muscles below the knees and elbows, with considerable atrophy in these muscles, and a loss of faradic excitability. The reflexes were absent in the paralyzed muscles. The muscles of the upper part of the limbs were also weak, but voluntary motion was not suspended. Such motion, however, as was possible was ataxic and uncertain. The trunk muscles had not escaped, and he was unable to turn in bed or to sit up. There was partial wrist drop,

complete foot drop, some tenderness along the muscles of the calves and of the forearms, but no sensory disturbance of any kind.

Under general tonic treatment, with massage and electricity to the paralyzed muscles, he soon began to improve, and, after a month, was able to go home, though he still could not stand alone or feed himself. His recovery was, however, continuous and rapid, and in June, 1893, he reported that he had regained complete power in all his muscles, and was quite well except for some shaking of his hands (ataxia ?) at times.

In August, 1894, he was readmitted to St. Luke's Hospital in about the same condition in which he had been on his first admission. The second attack had begun in July, and had gone on rapidly to almost total paralysis, again without pain or sensory disturbance save some numbness, and without any affection of the bladder or rectum. He was seen by Dr. Peterson in August, 1894, and by me in September, and we agreed upon the diagnosis of a multiple neuritis, but were unable to ascertain any cause. His progress to recovery was slow but continuous. In November he was able to leave the hospital, and in April, 1895, he reported himself as having regained complete power in all his muscles, though he complained of some formication and tremor in the right arm and hand.

On September 20, 1897, he presented himself at my office and complained of some numbness of his fingers and toes, of an awkwardness in fine motions, and a feeling of weakness in the hands and fatigue on walking far. I found a slight anæsthesia to touch, cold and heat and pain in the fingers, a decided weakness of the interossei of the hands, but no other symptoms of disease, careful examination of every organ being negative, and his appearance being that of a young athlete well developed in every respect. We were both, however, alarmed at the prospect of a return of his paralysis, and he consented to a life of quiet, and of care in diet, with the use of strong nerve tonics, and of cod-liver oil. But these precautions were of no avail, and in the course of a month he had developed an absolutely total paralysis of all the muscles of the extremities with rapid atrophy and loss of faradic reaction. The trunk muscles and muscles of the head and neck were also invaded. He could not sit up or turn in bed. His external ocular muscles were weak, so that he had a slight internal strabismus, and saw double. His speech was noticeably thick and pronunciation was imperfect, and soon after his

admission to the hospital deglutition became affected, so that he could swallow only with great difficulty. Then his respiration became suddenly unnatural, and it was found that there was no spontaneous action of the diaphragm. For two weeks his respiratory movements were wholly of the type seen in volitional labored breathing, and during this time he slept little, as respiration became uncertain and irregular when the conscious effort ceased. His pulse at this time was extremely rapid, but never intermittent or irregular. His bladder and rectum were always under perfect control. His mind was always clear and his courage good. Preparation was made to maintain artificial respiration, if needed, but this was never necessary. After two weeks the respiratory motions seemed to gradually become more natural, the diaphragm began to work again at night during sleep, and after a month its action at all times was natural. During the following month, after the improvement set in, it advanced rapidly in all the muscles, the muscles of the trunk and near the trunk regaining their power sooner than those of the distal parts of the extremities. It seemed safe to allow him to go home at Thanksgiving (November 25), and he reports, since that time, a steady improvement. At the height of his paralysis there was anæsthesia to touch, temperature and pain as high as his elbows and knees, but not in his face or on his trunk. The special senses were normal.

There are certain features in this case which are unusual. First, the occurrence of three attacks of the same disease. Second, the recovery after paralysis of the phrenic and pneumogastric nerves. Third, the uncertainty of causation.

First.—In cases of alcoholic neuritis recurrences are not infrequent. I have seen several such recurrences but have never seen a case which survived a second severe attack. Cases of arsenical neuritis usually develop after attempts at suicide by taking arsenic, and a single experience is usually sufficient to prevent the individual from making a second attempt in the same way. Cases of diphtheritic multiple neuritis, which present many of the features in the case here reported, do not, as a rule, recur. In fact, I have been unable to find in the literature any case of a recurrence of diphtheritic multiple neuritis. Recurrent neuritis after lead poisoning is not at all uncommon, but in these cases the neuritis is very limited in its distribution, the arms being affected chiefly, if not exclusively. I have no records of recurrent neuritis of malarial origin, but believe that

they occur. Other causes of neuritis, which are many,* are sufficiently rare to make a recurrence of the causation and a second attack of the disease extremely improbable.

Second.—Involvement of the pneumogastric, causing a rapid action of the heart, or of the phrenic nerve, causing paralysis of the diaphragm, are the two most serious and fatal complications of the disease. Gowers states that in alcoholic neuritis involvement of the pneumogastric in the second attack is almost uniformly fatal, and I can confirm this statement, having seen three cases die of the disease in this manner. A rapid increase in the rate of the pulse is therefore generally considered a bad prognostic sign in the course of the disease. When the phrenic is also paralyzed, and the diaphragm ceases to work, the case becomes at once alarming. Thus in the patient whose history is here recorded, the efforts at breathing, the forcible respiratory movements of a volitional character, involving all the accessory muscles of respiration as well as those in ordinary use, presented a picture of distress and of an effort that was extremely alarming, and it was noticed that sleep was much interfered with during the time this paralysis persisted, because the irregularity of respiration which developed as soon as the conscious effort was removed resulted in an uneasiness which caused immediate waking. During the time that the diaphragm was paralyzed voluntary movements of the abdominal walls were perfectly possible, but such movements naturally did not attend the respiratory action and had no influence whatever upon the ingress or egress of air. The contrast between the distention of the abdomen as the diaphragm descends in a healthy person in deep respiration, and the immovable condition of this patient's abdomen during his intense efforts at respiration, was very marked.

Third.—The causation of the multiple neuritis in this case could not be wholly determined. It was easily possible to rule out alcohol and all forms of extraneous poisons. Examination of the blood failed to reveal any malarial plasmodium. The suspicion was awakened of the possibility of diphtheria as a cause, because of the fact that the disease had developed without pain, because the muscles of the tongue and also of the eyes were involved in the paralysis,

* See the Middleton-Goldsmith Lectures for 1887 upon Multiple Neuritis, by M. Allen Starr. Gowers, *Diseases of the Nervous System*, second edition, vol. i, p. 108; Multiple Neuritis.

and because of the history of slight ataxic conditions in the previous attacks and the development of a marked ataxia in this case when the paralysis subsided. Careful questioning failed to reveal any history of a sore throat, or any symptom of diphtheria preceding this attack, either in the individual or in any one of the family, or in the town in which he lived. Cultures were made from his throat on several occasions while in the hospital, and although a bacillus was found which resembled the Loeffler bacillus, yet inoculations with the cultures of this bacillus into guinea-pigs failed to produce any symptoms. The existence of this bacillus, however, in the throat seems to indicate that diphtheria of a slight character may have been the cause of the neuritis in this particular attack; though it does not prove it, as healthy persons may carry the Loeffler bacillus without symptoms. Whether it was the cause of the preceding attacks must be left as an open question, though on both occasions while at St. Luke's Hospital investigation failed to reveal any cause of the disease. No cultures, however, were made at that time from his throat.

If diphtheria was the cause in this particular case, it is interesting as an evidence of the particular susceptibility of this man's nervous system to the diphtheritic poison. It is also interesting as an evidence of the possibility of recurrent neuritis following diphtheria or following slight infections by diphtheria. It is because of these unusual characteristics that the case has been reported.

III.

HYDROCHLORIC-ACID DETERMINATIONS IN GASTRIC CONTENTS.

BY J. S. THACHER, M.D.

IN a subject so unsettled as the methods of analysis of gastric contents and the interpretation of the findings, perhaps any contribution of systematic observations may be helpful.

In the Pathological Department of this hospital I find records of two hundred and seventy-five examinations of gastric contents, and forty examinations of artificial mixtures. Most of these include both qualitative tests and quantitative determinations. Many of them, however, can be of no help to us because the specimens were not obtained under the right conditions, and others were too scant to allow of more than a partial examination. There remain, nevertheless, a considerable number of reliable analyses; enough, perhaps, to make it worth while to add them to the gradually accumulating data from which we hope some day to arrive at a more satisfactory knowledge of the clinical significance of the hydrochloric acid of the gastric juice and the ways of determining its presence and condition.

The unsatisfactory state of the subject is due to various causes. One factor is the looseness with which the expression "free hydrochloric acid" is used. It is used with different meanings, and again apparently without definite meaning. This is, perhaps, a natural result of the recent date of the discovery, and the incompleteness of our knowledge of the different states in which hydrochloric acid exists in the stomach. When Bidder and Schmidt* at last demonstrated that the proper active acid of the stomach was hydrochloric acid, and determined its amount, they worked on gastric juice un-mixed with food, and the acid present was entirely free. The entire acid secreted by the glands of the stomach was therefore spoken of as free hydrochloric acid; and by others, too, though mixed with various foods, so far as it had not united with mineral bases

* Die Verdauungssäfte und der Stoffwechsel, 1852.

to form simple chlorides, but retained acid properties, it was still spoken of in the same way, regardless of what changes might have occurred through this admixture limiting its freedom. The discussions which followed Von der Velden's* paper on the absence of hydrochloric acid in dilatation of the stomach due to cancer made no distinction between free hydrochloric acid and total hydrochloric acid. This was no doubt proper, so long as no evidence arose of any modification of the freedom of the acid, or any part of it, by the presence of other elements of the gastric contents. But after a time, when new methods of estimating the quantity of this acid were devised, it was found that there was more of the acid present than would respond to the color-tests then in use for detecting the presence of hydrochloric acids.† In other words, of the total hydrochloric acid, only a part could be drawn to unite with methyl-violet or tropæolin, only a part was free to form those combinations and produce those changes of color. Later in the exploration of this obscure field of research it was shown‡ that albuminous bodies and other organic substances were able to seize the hydrochloric acid, or a part of it, and to hold it with some firmness. Not securely enough, however, to keep it from revealing itself to the chemist, by uniting with ordinary alkalis or with such coloring matters as litmus and phenolphthalein. That part of the hydrochloric acid which enjoyed sufficient freedom to allow it to attach itself to tropæolin or Günzburg's reagent, came to be called "free," while the remainder, partially restrained by the organic substances present, though still able to manifest the ordinary activities of acids, acquired the designation "combined." Such as had united with mineral bases to form simple salts, like sodium chloride, was no longer an acid, and was definitely lost from that category. This division of the hydrochloric acid of gastric contents into "free" and "combined," though somewhat arbitrarily named, is an actual difference. But the decade which has elapsed since the distinction was established, has hardly sufficed for the distinction to become appreciated by the medical mind, or for the medical pen to acquire accuracy in the use of the terms, and the words "free hydrochloric acid" have hardly ceased to be used as meaning the total hydrochloric acid—which is, to be sure, free to

* Deutsch. Arch. f. kl. Med., vol. xxiii., p. 369, 1879.

† Honigsmann and Von Norden, Zeit. f. kl. Med., vol. xiii., p. 87, 1888.

‡ Klemperer, Zeitsch. f. kl. Med., vol. xiv., p. 147, 1888.

manifest itself in most of the ways of acids, but is not all of it free in the technical sense which the profession have allowed the term to acquire. By our slowness in understanding this distinction, and our carelessness in using the terms, much difficulty has been added to this obscure subject. Some doubt still arises at times when we read reports of analyses, as to what the author means in speaking of free hydrochloric acid, and to settle the doubt we often have to inquire what method of analyses he has used.

This matter has been to a slight degree unsettled again by the introduction of a new criterion, a new method of distinction between the free and the combined hydrochloric acid. Hayem and Winter* have advanced and advocated the use of evaporation as a means of distinguishing these two forms or conditions of the acid, and on this method have based a valuable series of clinical observations, as well as some interesting physiological theories. They insist that in evaporating a specimen of gastric contents to dryness over the hot-water bath, all of the free hydrochloric acid is driven off, and none of the combined. Their results are fairly consistent, and yet some doubt remains whether among the degrees of freedom possessed by the different particles of the acid, this method of evaporation draws the line at exactly the same point where it is drawn by the method of color-tests.

A further manifestation of indefiniteness in our considerations of these matters is in the use of the terms "free acid" and "total acidity." They are often used when only the hydrochloric acid is meant, yet "free acid" properly includes organic acids as well as hydrochloric, and "total acidity," the acidity of free and combined hydrochloric acid, of organic acids, and of acid salts. It is hoped that we shall soon come to a clear understanding and a careful use of these various terms. The clearing up of the whole subject must surely thereby be greatly advanced.

A difficulty of quite another kind is found in the necessity of obtaining specimens under certain constant conditions. The response of the stomach to various stimuli is such that the character and quantity of the juice secreted vary with the character and quantity of food introduced. The same factors also modify the rapidity of secretion and the time of its maximum richness in hydrochloric acid. It is therefore necessary that exact rules be observed as to the amount and the kind of food given the patient before obtaining the

* Du chimisme stomacal, 1891.

specimen, and the time of expressing it. The rules which we have followed as far as possible are these :

1. The patient's breakfast shall consist of a large cup of weak tea without milk or sugar, and a piece of stale bread as large as half the hand, without butter (Ewald's test-breakfast).

2. The specimen shall be obtained by the stomach-tube one hour after the test-breakfast is begun, and without putting in any water to aid in the extraction.

3. No other food or drink, nor any medicine, shall be taken by the patient that morning until after the specimen has been obtained.

It is naturally difficult to secure the exact observance of these rules. The patient, not appreciating their importance, or being quite indifferent, may not take the uninteresting meal as prescribed, or may supplement it without confessing. It is not to be expected that every patient in a hospital will refrain even from a drink of water on these occasions. Moreover, it is not always easy to get out what there is in the stomach. It is, as a rule, necessary to accustom the patient by repeated sessions to the unnatural process. Even after this, on many occasions, nothing is to be obtained unless some water is introduced, and this departure from the rule would naturally, among the crowded duties of the nurse, sometimes fail to be recorded. To sustain as far as practicable an observance of the rules, and keep us from being misled by departures from them, blanks like the following have been put in the wards with the request that one be filled and returned with each specimen.

Wd.....Name.....Date.....

at.....the pt. received a test-breakfast consisting of

at.....the gastric contents were obtained by

What food, drink or medicine, besides the test-breakfast, did the pt.
take to-day before the specimen was obtained ?

Was any water put in to help get the specimen ?

Even with this protection and help it has seemed necessary to look for internal evidence of dilution and to throw out, at least from any confident consideration, such analyses as show all the values, especially those of the total acidity and the fixed chlorides, far below the normal.

Specimens very scant in amount have also been excluded from consideration except in special cases, for it has seemed, both on theoretical grounds and from experience, that they often do not represent the gastric powers. In some of these cases the stomach has probably passed on most of its contents into the intestine, a little mucus or saliva being about all that remains.

Difficulties incident to the several methods of analysis will be spoken of later, but it is not because they are insignificant that they are here lightly passed over. On the contrary, all the methods have elements of uncertainty, though in varying degree, and some of them are also tedious and laborious.

Nor must we forget that arithmetical and clerical errors may creep in, even in the best regulated laboratories, a possibility which again impairs our faith in the infallibility of reported analyses. These difficulties indicate the importance of the individual factor on the part of the examiner. To properly carry out the more elaborate methods, considerable familiarity with general chemical work is indispensable, and even for the simple methods much experience with the individual tests is necessary, as well as considerable judgment, before the analyses can be accepted as reliable. To satisfy this requirement I secured the help of an assistant with some experience in analytical work in organic chemistry. I am indebted to Miss Selma Granat for the technical execution of the chemical examinations reported in this paper, as well as for much of the clerical work. And yet the first analyses made under this arrangement do not appear to be so consistent, either with one another, or with our other knowledge of the subject, as those made later, indicating again the importance of experience in this work. Accordingly, the first twenty of her examinations, as well as all made previously, have been excluded from our tables.

Beyond all these grounds for hesitancy in accepting fully the reports of such analyses, or deducing finely drawn conclusions from them, there is the ever-present fact of the complexity and variability of nature, even of physiological and pathological human nature.

We should not trust too much to single analyses or to single threads of scientific argument, either in forming our pathological generalizations or in judging of the condition of individual patients, but, while accepting suggestions from the laboratories, which may be very helpful, we should maintain a wide outlook and broad judgment.

The methods of determining the hydrochloric acid in the gastric juice may be arranged in three groups :

1. Those in which the acids of different kinds and conditions are directly detected by color-reactions. These may be qualitative merely, or may be made quantitative by titration with sodium hydrate.

2. Those in which the different states of combination of chlorine are separated by evaporation or incineration, and the chlorine of the several groups then estimated by its union with silver.

3. Those in which use is made of the affinities of acids for various substances, the amounts of the resulting combinations being determined by various methods.

In the first group, a large number of substances have been used and lauded for their color-reactions with various acid substances. There are some which *react to all the varieties of acid ingredients* of gastric contents, to the free acids, both hydrochloric and organic, to acid salts, and to "combined" hydrochloric acid. Such are litmus and phenolphthalein, and these are of great value, for they may be used not only for qualitative testing but also by the aid of sodic hydrate titration, for quantitative determinations of total acidity. Phenolphthalein has come into general acceptance as reliable and convenient, and has of late largely supplanted litmus in quantitative examinations in spite of the suspicion roused by Mintz * and Jaworski, who argue from their observations that in the presence of combined hydrochloric acid it gives too high results. It is phenolphthalein by which total acidity has been determined in our specimens.

At the other end of the group stand two reagents which are generally admitted to *respond only to free hydrochloric acid*. Organic acids, combined hydrochloric acid and acid salts will not go to them. Only that hydrochloric acid which is par excellence free, will unite with them and produce the characteristic colors. They are Günzburg's solution of phloroglucin and vanillin, and Boas' solution

* Deutsche Med. Wochenschr., vol. xvii., p. 1398, 1891.

of resorcin and cane-sugar. They are to a high degree and about equally sensitive, and have stood the test of many years' use. Though some observations of Mierzynski's* indicate that they may be affected by acid phosphates, which are sometimes present in the stomach, these two reagents keep their place as reliable guides to the presence or absence of free hydrochloric acid. We have used the Günzburg reagent as a matter of routine, and the resorcin frequently. The records show that 67 specimens were tested both by Günzburg's phloroglucin-vanillin test, and by Boas' resorcin test. The results are given below, and it is interesting to see the complete agreement of the two tests. In only 1 case out of the 67 is there any difference in the recorded reactions, and that only the difference between "faint" and "very faint," an agreement which holds whether the free hydrochloric acid is abundant, scant, or entirely absent, in specimens from all kinds of cases and presumably of all sorts of composition. Each method then supports the other and bears faithful testimony to the other's accuracy. When two methods invariably give the same result, there can hardly be any fault in the technique, or any doubt that there is some varying property of the specimens to which the tests respond with sensitive accuracy.

TABLE I.

Specimens examined both by Günzburg's phloroglucin-vanillin test and by Boas' resorcin test.

Each test gives a strong reaction.....	19
“ “ “ good “	1
“ “ “ faint “	1
Boas' test gives a faint reaction, while Günzburg's gives a very faint reaction	1
Neither test gives a reaction.....	45
Total	67

The comparison of results of the phloroglucin-vanillin test with those of the Hayem and Winter and with those of Töpfer's dimethyl-amido-azo-benzol test may be seen in Tables II., III., and IV. Günzburg's solution is often used also for quantitative analysis, by the aid of titration with sodium hydrate. This procedure goes by the

* Centralbl. f. kl. Med., vol. xiii., p. 433, 1892.

name of Mintz's test, and is, perhaps, the most reliable test that we have for determining the quantity of free hydrochloric acid. It takes some time, from ten to thirty minutes, for after each addition of the decinormal sodium hydrate solution a drop has to be evaporated with a drop of the test solution over the hot-water bath. But it is more reliable than any of the other quantitative color-tests, and more simple and easy than any of the analyses based on other principles. A comparison between the results which it gives and those given by Töpfer's and by Winter's method can be seen in Tables II., III., and IV.

The exact correspondence between Töpfer and Mintz values in specimens 324-330, artificial mixtures of egg albumen, oatmeal, and hydrochloric acid, indicates the accuracy of each method in the case of such mixtures. A comparison of specimen 326 with 331, of 327 with 332, 333, and 334 is also instructive. In each case the only change of ingredients is the addition of lactic acid. The Mintz value remains practically unchanged, though the congo-red test shows a great change.

Methyl-violet and congo-red are two coloring matters which have been used in these examinations, and are still used when only approximate results are wanted. Methyl-violet is not very sensitive. Congo-red is quite sensitive to lactic acid,* so that if there is much lactic acid present it will not prove that free hydrochloric acid is there, and much less therefore can it be used to determine the amount of such acid. This is well shown in Table III., specimens 331-334. Congo-red is rather an indicator of free acids, of whatever kind. It is used in solution and in paper soaked with the dye. When the solution is used for quantitative analysis, by the aid of sodium hydrate titration, the method sometimes goes by Boas' name. If the paper is thus used, by Mörner's name. Tropæolin OO is the name of another dye that has been used for estimating the amount of free hydrochloric acid, notably as a part of Lüttke's method. But even Lüttke admits that it is also acted on by other free acids.† Another color-test has recently come into wide acceptance as a convenient and reliable means of measuring free hydrochloric acid, that of Töpfer,‡ in which we use a solution of dimethyl-amido-azo-

* Ewald, *Verdauungskrankheiten*, Pt. II., p. 30, 1888.

† Martius and Lüttke, *Die Magensäure des Menschen*, p. 44, 1892.

‡ *Zeitschr. f. Phys. Chemie*, vol. xix., p. 104, 1894.

benzol. A drop of a one-half per cent. alcoholic solution of this substance added to 10 c.c. of gastric contents produces a bright red color if free hydrochloric acid is present. Titration follows, with decinormal sodium hydrate solution.

This method has received the approval of such authorities as Mohr,* Peltyn, Håri,† Friedenwald,‡ Simon,§ and Hemmeter.|| Peltyn, after making a series of comparative tests, concludes that it is the most sensitive of the tests for free hydrochloric acid, and gives very small variations from values found by the Mintz and the Hehner-Seemann (Braun) method. Håri has compared it with the newer Sjoquist method and his modified Braun method, with results as accurate as by either of those methods. But he excepts cases where there is no free hydrochloric acid present as giving misleading results, and Peltyn adds the serious qualification that when organic acids are present in greater abundance than two per cent., other methods must be used. Moreover, Strauss¶ and Edsall** find the change of color so gradual that it is difficult to determine just when it can be said to occur. Strauss, Edsall, and Einhorn†† have demonstrated that the dye possesses a considerable sensitiveness to lactic acid, and Alexejew also warns against it when the percentage of lactic acid is high.

There is, moreover, some difference of opinion as to what stage of color-change marks the completed reaction. Strauss and Hemmeter say go on to pure yellow; Mohr and Håri say stop when red has changed to orange.

Our experience with this test has been that in artificial mixtures when hydrochloric acid is the acid substance present, dimethyl-amido-azo-benzol gives results which, as a rule, correspond perfectly with the phenolphthalein or Mintz's test, but must be pushed to the final change to pure yellow, that change being easily recognized. The correspondence between this test and Mintz's in such solutions appears in this table.

* Zeitsch. f. Phys. Chemie, vol. xix., p. 647, 1894.

† Arch. f. Verdauungskr., vol. ii., p. 332, 1896.

‡ New York Medical Record, p. 431, April 6, 1895.

§ Clinical Diagnosis, p. 112, 1896.

|| Diseases of the Stomach, p. 155, 1897.

¶ Deutsch. Arch. f. kl. Med., vol. lvi., p. 87, 1895.

** University Medical Magazine, vol. ix., p. 797, 1896-97.

†† New York Medical Journal, p. 602, May 9, 1896.

TABLE II.

		H.	C.	H. + C.			H.	C.	H. + C.
No. 324.					No. 328.				
HCl. .35 per cent. (?)	Winter...	.256	.058	.314	HCl. .175 per cent. (?)	Winter ..	.088	.073	.161
Egg albumen, 2 per cent.	Töpfer...	.332	.010	.342	Egg albumen, 3 per cent.	Töpfer...	.149	.010	.159
Oatmeal.	Mintz....	.332	.....	.....	Oatmeal.	Mintz....	.149	.....	.....
	Congo ...	.335	.....	.....		Congo ...	.156	.....	.....
No. 325.					No. 329.				
HCl. .175 per cent. (?)	Winter...	.102	.073	.175	HCl. .087 per cent. (?)	Winter ..	.073	.036	.109
Egg albumen, 2 per cent.	Töpfer...	.156	.010	.166	Egg albumen, 1.5 per cent.	Töpfer...	.083	.007	.090
Oatmeal.	Mintz....	.156	.....	.....	Oatmeal.	Mintz....	.087	.....	.....
	Congo ...	.153	.....	.....		Congo ...	.083	.....	.....
No. 326.					No. 330.				
HCl. .087 per cent. (?)	Winter...	.014	.073	.087	HCl. .175 per cent. (?)	Winter ..	.132	.036	.168
Egg albumen, 2 per cent.	Töpfer...	.069	.003	.072	Egg albumen, .5 per cent.	Töpfer...	.167	.003	.170
Oatmeal.	Mintz....	.069	.....	.....	Oatmeal.	Mintz....	.167	.....	.....
	Congo ...	.073	.....	.....		Congo ...	.171	.....	.....
No. 327.									
HCl. .087 per cent. (?)	Winter...	.066	.00	.066					
Egg albumen, 1 per cent.	Töpfer...	.080	.007	.087					
Oatmeal.	Mintz....	.080	.....	.....					
	Congo ...	.083	.....	.....					

In this and the following tables A. means total acidity, H. free hydrochloric acid, C. combined hydrochloric acid, and F. fixed chlorides.

But if lactic acid was added to the mixtures, great difficulty was experienced in determining the point of reaction; and to get values at all corresponding to those given by the Mintz test, or to the known percentage of acid, the earlier change from red to orange must be observed.

TABLE III.

		H.	C.	H. + C.			H.	C.	H. + C.
No. 331.					No. 333.				
Mixture No. 326 and about 1 per cent. lactic acid.	Töpfer...	.065, .142	.018	.083	Mixture No. 327 and about 1 per cent. lactic acid.	Töpfer...	.083, .113	.010	.093
	Mintz....	.073	.....	.....		Mintz....	.083	.....	.....
	Congo ...	.456	.....	.....					
No. 332.					No. 334.				
Mixture No. 327 and about 1 per cent. lactic acid.	Töpfer...	.080, .113	.004	.084	Mixture No. 327 and about 5 per cent. lactic acid.	Töpfer...	.087, .164	.007	.094
	Mintz....	.087	.....	.....		Mintz....	.091	...	.....
	Congo .	.164	.....	.....					

In clinical specimens of gastric contents the same difficulties were experienced.

TABLE IV.

		H.	C.	H. + C.			H.	C.	H. + C.
No. 296.1.	Winter... Töpfer... Günzburg	.00 .00 .0	.087 .027	.087 .027	No. 307b. Specimen diluted ...	Winter... Töpfer... Mintz...	.007 .018, .023 .021	.040 .010	.047 .028
No. 296.2.	Winter... Töpfer... Günzburg	.00 .00 .0	.138 .010	.138 .010	No. 313.	Winter... Töpfer... Mintz...	.017 .032, .047 .018	.077 .025	.094 .057
No. 297.	Winter... Töpfer... Günzburg	.00 .00 .0	.022 .028	.022 .028	No. 314.	Winter... Töpfer... Mintz...	.007 .014, .043 .009	.117 .021	.124 .035
No. 298.	Winter... Töpfer... Günzburg	.036 .074 Good ..	.110 .029	.146 .103	No. 315.	Winter... Töpfer... Mintz ...	.029 .043, .083 .043	.088 .029	.117 .072
No. 299.	Winter... Töpfer... Günzburg	.025 .109 Marked	.153 .083	.178 .192	No. 317.	Winter... Töpfer... Mintz...	.052 .069, .120 .083	.116 .029	.168 .098
No. 300.	Winter... Töpfer... Günzburg	.043 .152 Good ..	.197 .043	.240 .195	No. 317a. Same as No. 317 four days later.	Winter... Töpfer... Mintz...	.037 .076, .113 Marked	.138 .047	.175 .123
No. 301.	Winter... Töpfer... Günzburg	.044 .211 Good ..	.292 .080	.336 .291	No. 318.	Winter... Töpfer... Mintz...	.007 .018, .025 .012	.015 .010	.022 .028
No. 302.	Winter... Töpfer... Mintz... Congo ...	.022 .098 .051 .124	.088 .032	.110 .130	No. 308. Egg albumen and water, and about .175 per cent. HCl.	Winter... Töpfer... Mintz ...	.117 .113, .131 .105	.113 .007	.241 .120
No. 303.	Winter... Töpfer... Mintz... Congo ...	.021 .102 .051 .127	.088 .025	.109 .127	No. 309. Gastric juice No. 305 and mintz No. 308 in equal parts.	Winter... Töpfer... Mintz...	.023 .063, .093 .051	.148 .038	.171 .101
No. 304.	Winter... Mintz... Congo ...	.029 .036 .091	.066	.095	No. 310. One part gastric juice No. 307b and two parts mixture No. 308.	Winter... Töpfer... Mintz ...	.029 .076, .088 .073	.095 .014	.124 .090
No. 305.	Winter... Töpfer... Mintz....	.007 .036, .065 .007	.132 .039	.139 .075	No. 311. Mixture No. 308 and gastric juice.	Winter... Töpfer... Mintz	.029 .105, .142 .094	.176 .014	.205 .119
No. 307a.	Töpfer... Mintz....	.065, .147 .109	..... .....	..... .....					

In the above tables two numbers are sometimes given in the Töpfer values of H. The former is that obtained by observing the first change to orange, the latter by observing the final change to yellow.

The difficulty in recognizing the change of color can be diminished by using a test-tube, held in the light against a white background, and still further, by having a second test-tube for constant comparison, in which the other ingredients are put, but not the alka-

line solution. But even then the determination is often difficult, and one cannot feel sure which color limit, yellow or orange, is the one to observe in a given case. While, therefore, the experience of good observers indicates that results quite near the truth may be obtained in most cases, it seems safer to use the rather more tedious Mintz method.

The complete Töpfer examination includes a test with phenolphthalein for the total acidity, and a test with alizarin, which is said to give all the acidity except that due to "combined" hydrochloric acid. The difference of these two would then give the combined hydrochloric acid. And by this procedure we do get values, at least in the simple artificial mixtures, which are very close to the truth. But with alizarin, too, it is not always easy to say just when the reaction occurs, and rather than obtain a value for H. + C., the total hydrochloric acid, by a method involving three quantitative color-tests, it seems better, if practicable, to take one of the more difficult, but more surely established, methods to be mentioned later.

We come now to the second group of methods, depending upon evaporation to drive off the free from the combined hydrochloric acid, and incineration to drive off the latter from the "fixed," the mineral chlorides. In the Hayem and Winter method, a measured quantity of the specimen is put into each of three dishes, a, b, and c; some sodium carbonate, to excess, is added to each of the dishes, to a as it is, to b after evaporation, and to c after incineration, to fix the hydrochloric acid. The chlorine in each dish is then determined by titration with a standard solution of nitrate of silver. The results expressed in equivalents of hydrochloric acid, will give us the total chlorine from dish a, the chlorine, excepting that of the free hydrochloric acid, from dish b, and the fixed chlorides from dish c. The differences are the free and the combined hydrochloric acid. This method has been pronounced by some, Langermann,* Teschlenoff,† Ralfe and Fenwick,‡ to be a valuable one, among the most reliable that we have. On the other hand, Mintz,§ and Martius and Lüttke||

* Virchow's Archives, vol. cxxviii., p. 408, 1892.

† Corresp. f. Schweizer Aerzte, vol. xxii., p. 735, 1892.

‡ Allbutt's System of Medicine, vol. iv., p. 291, 1897.

§ Deutsch. Med. Woch., vol. xvii., p. 1397, 1891.

|| Die Magensäure, etc., p. 97, 1892.

argue that the method does not give correct values ; that while the values obtained for H. + C. may be reliable, those for H. are not, but are apt to be much too low, while Biernacki* maintains that it gives correct values for H. but excessive values for H. + C. Other criticisms, but inconsistent with these or with one another, have also been made.

Our experience with this method may be seen in the various tables given herewith. A comparison of its results with those of the qualitative G $\ddot{u}$ nzburg test is given in Table V.

TABLE V.

Free HCl. by Winter's Method.	G $\ddot{u}$ NZBURG'S REACTION.		
	Strong.	Faint.	None.
Above 60.....	18	0	0
41 to 60.....	10	0	0
21 to 40.....	21	3	1
11 to 20.....	8	2	2
1 to 10.....	2	5	8
0.....	0	0	55

We see how few of the cases which by the Hayem-Winter method show any considerable free hydrochloric acid, failed to give the G $\ddot{u}$ nzburg reaction, and, on the other hand, how few cases giving very low values for H. by the Hayem-Winter method, responded to the G $\ddot{u}$ nzburg. This agreement, while far from ideally perfect, still shows that neither method is likely, in a given case, to take us far wrong.

Table VI. gives us a number of duplicate analyses made on the same specimens, with the object of testing the technique of the examinations.

From this table we see that large differences are comparatively few, but frequent enough to make it desirable that the uncertainties of faults of technique be eliminated by repeating the examination until identical results are found.

* Centralbl. f. kl. Med., vol. xiii., p. 409, 1892.

TABLE VI.—DUPLICATE TESTS OF THE SAME SPECIMEN.

	A.	a.	b.	c.		A.	a.	b.	c.
No. 120.	.039	.065	.065	.043	No. 294.1.	.299	.290	.290	.159
Difference.....		.065	.051	.036		.297	.297	.166	
		.000	.014	.007	Difference.....		.007	.007	.007
No. 133.	.045	.175	.175	.043	No. 299.	.222	.413	.392	.225
Difference.....		.065	.065	.051		.413	.384	.225	
		.110	.110	.008	Difference.....		.000	.008	.000
No. 140.	.078	.094	.094	.080	No. 313.	.113	.233	.219	.146
Difference.....		.102	.094	.087		.240	.219	.138	
		.008	.000	.007	Difference.....		.007	.000	.008
No. 144.	.279	.284	.262	.167	No. 314.	.146	.284	.277	.160
Difference.....		.343	.299	.189		.284	.277	.167	
		.059	.037	.022	Difference.....		.000	.000	.007
No. 147.	.035	.138	.138	.116	No. 290.				
Difference.....		.124	.124	.080	By tube.....	.377	.284	.277	.102
		.014	.014	.036	By vomiting at same time		.277	.270	.131
No. 126.	.032	.073	.087	.065	Difference.....		.007	.007	.029
Difference.....		.080	.080	.058	Artificial mixture A.	.019	.014	.014	.014
		.007	.007	.007	Oatmeal gruel.	.013	.014	.014	.014
No. 227.	.208	.189	.175	.131	Eleven specimens exam-	.013	.014	.014	.014
Difference.....		.189	.175	.138	ined.	.013	.014	.014	.014
		.000	.000	.007		.013	.014	.014	.014
No. 180.	.026	.109	.109	.080		.013	.014	.014	.014
Difference.....		.109	.109	.080		.013	.014	.014	.014
		.000	.000	.000		.013	.014	.014	.014
No. 181.	.520	.430	.408	.219	Artificial mixture B.	.078	.116	.087	.058
Difference.....		.438	.408	.219	Oatmeal gruel + HCl.	.078	.116	.087	.058
		.008	.000	.000	Three specimens exam-				
No. 182.	.494	.438	.401	.284	ined.	.078	.116	.087	.058
Difference.....		.445	.408	.211	Artificial mixture C.	.234	.262	.160	.138
		.007	.007	.073	Oatmeal gruel + HCl.	.270	.284	.153	.146
No. 192.	.416	.386	.350	.219	Eight specimens exam-	.247	.194	.146	.138
Difference.....		.357	.298	.219	ined.	.234	.262	.175	.131
		.029	.052	.000		.234	.277	.153	.146
No. 210.	.117	.189	.189	.138		.236	.255	.146	.138
Difference.....		.219	.219	.146	Put in incubator one hour	.227	.284	.146	.138
		.030	.030	.008		.240	.270	.153	.131
No. 251.	.052	.189	.189	.189	Artificial mixture D.	.253	.270	.167	.146
Difference.....		.204	.204	.204	Oatmeal gruel + HCl.	.250	.284	.146	.138
		.015	.015	.015	Three specimens exam-				
No. 270.	.734	.248	.248	.233	ined.	.266	.277	.160	.146
Difference.....		.253	.255	.233	Artificial mixture E.	.061	.094	.073	.029
		.007	.007	.000	Oatmeal gruel and HCl.	.061	.087	.065	.021
No. 276.	.162	.226	.226	.189	Two specimens examined				
Difference.....		.233	.233	.182					
		.007	.007	.007					
No. 283.	.266	.226	.226	.204					
Difference.....		.226	.226	.197					
		.000	.000	.007					

Table VII. gives a number of observations where a specimen was kept from one to nine days after its first examination and was then examined again. We see a considerable variety of results. In some cases the figures of the two examinations are almost identical; in others there is a rather wide difference. It does not, of course, appear whether the difference is due to faulty technique and clerical errors, or to chemical changes and evaporation undergone in the meantime. But the small number of large differences speaks well for working of the method as a rule.

TABLE VII.—SAME SPECIMEN EXAMINED ON DIFFERENT DAYS.

	A.	a.	b.	c.		A.	a.	b.	c.
No. 123.	.013	.036	.029	.021	No. 213.	.019	.167	.158	.109
Six days later....	.091	.021	.021	.021	Eight days later.	.299	.167	.153	.116
Three days later...	.130	.021	.021	.021	No. 221.	.273	.233	.182	.102
No. 126.	.032	.076	.083	.061	Two days later...	....	.279	.....	.102
Three days later ..	.045	.080	.080	.051	No. 227.	.208	.189	.175	.134
No. 138	.539	.423	.401	.204	Nine days later ..	.201	.189	.182	.146
Five days later....	.....	.496	.474	.204	No. 232.	.110	.182	.182	.182
No. 176.	.117	.....	.....	.....	One day later....	.....	.175	.175	.167
Two days later....	.143	.....	.....	.....	No. 317.	.193	.365	.313	.197
No. 179.	.487	.374	.284	.233	Four days later..	.211	.372	.335	.197
One day later....	.526	.438	.350	.182	No. 182.	.494	.438	.401	.284
No. 198.	.533	.401	.277	.110	One day later....	.539	.445	.408	.211
Three days later ..	.....	.386	.333	.116	No. 181.	.520	.416	.401	.219
No. 207.	.390	.423	.357	.175	One day later....	.....	.430	.408	.219
Two days later....	.....	.306	.292	.197			.438	.408	.219
Five days later....	.....	.365	.357	.211			.452	.422	.219
No. 212.	.032	.138	.131	.116					
Five days later....	.....	.146	.146	.116					

A comparison of the Hayem and Winter with the Mintz method, as shown in Tables II. and IV., presents but little regularity as to the differences in results when gastric contents are studied, except that the values of H., obtained by the evaporation process, are almost always smaller than those obtained by the phloroglucin. In the simpler, artificial mixtures, however, the difference is strikingly uniform. This agrees with the results of Mintz's own comparison of the two methods, and to some extent with Lüttke's rather loose observations on which he based his condemnation of the Hayem-Winter method. We are brought to the conclusion that while the difference is not great, still evaporation does not separate free and combined

hydrochloric acid in the same proportion in which the color-tests do. It may be that the distinction which evaporation makes between different degrees of freedom corresponds to as true a difference as in the case of the color-tests. But we want no more complications in these methods than are necessary, and so it seems better to adhere to the first and best established meaning of free hydrochloric acid as that which responds to the phloroglucin-vanillin and equivalent tests, and to make our observations so that they can be recorded in simple accordance with that definition. While, therefore, the Hayem-Winter process gives figures which seem to closely approximate the truth, the determination of the free hydrochloric acid is better made by the Mintz method. For the determination of the total hydrochloric acid there is a quite general agreement that the Hayem-Winter method is reliable. Biernacki* and Kossler† think they show that some of the chlorine of the fixed chlorides may be lost during incineration in the presence of acid phosphates, but the values found by other observers as well as by us for H. + C., and depending on the determinations of the fixed chlorides, correspond quite closely to the values found by other and reliable methods, and in the case of artificial mixtures to the quantities known to be present.

Lüttke uses the incineration method to determine the H. + C., and titration with tropæolin to determine H. The objections to tropæolin have been spoken of above.

Of the third group of methods, depending on the affinities of the acids for substances other than the test-colors or chromogens, we have used none in our analyses. They are all of them tests for the total hydrochloric acid and do not determine the free.

The best of them are Hehner and Seemann's, also called Braun's, Leo's, and Sjoquist's.

In Hehner and Seemann's (Braun's) process, the total acidity is found by titrating with phenolphthalein. To another portion is added a measured quantity of sodium hydrate solution, more than enough to neutralize. It is then incinerated, the chlorides remaining unchanged, but the organic salts of sodium being changed to carbonates. Now sulphuric acid is added in quantity equal to that of the sodium hydrate first added. The excess of alkali will neutralize an equivalent of the acid, and the carbonates will neutralize a further

* Centralbl. f. kl. Med., vol. xiii., p. 499.

† Zeitschr. f. phys. Chem., vol. xvii., p. 91, 1893.

portion of the acid, leaving unneutralized a portion corresponding to the chlorides produced by the hydrochloric acid acting on the sodium hydrate, that is equivalent to the amount of that acid in the portion of the specimen taken. By titrating then the acid left unneutralized, we find the value of $H. + C.$

As Kossler and Håri have pointed out, the acid phosphates may cause an error, but Håri has suggested the use of an indicator in the final titration not sensitive to acid phosphates. By using dimethyl-amido-azo-benzol for this he shows very good results. Even without this added caution, the method has been found trustworthy.

Leo neutralizes the acids, including the combined hydrochloric acid, with an excess of calcium carbonate. The acid phosphates are not neutralized. If then the organic acids be removed or already absent, or their value subtracted, the loss of acidity produced by the calcium carbonate gives the amount of $H. + C.$ The drawback to this method lies in the difficulty of getting rid of the organic acids, or measuring them for subtraction. Until we learn how to do that more satisfactorily than we now can, Leo's method can hardly find full acceptance.

Sjoquist precipitates the various acids with carbonate of barium. Incineration then changes the barium salts of the organic acids to carbonates, from which the chloride of barium can be separated by washing through a filter with hot water. Though the method is considered one of the most reliable that we have, some severe theoretical criticisms of it have been made, and there is good reason to doubt the accuracy of the separation of chlorides and carbonates of barium by the hot water and filtration.

Weighing both ease and accuracy, we must perhaps give the first place in this group to Hehner and Seemann (Braun).

We conclude, then, that for determining the total hydrochloric acid, the Hehner-Seemann (Braun) method or one of the incineration methods, Hayem-Winter or Lüttke, is the best for ordinary laboratory work. The practitioner who is limited to simple titration methods can, however, use that part of the Töpfer method which gives $H. + C.$ with confidence that he will generally get results sufficiently accurate for clinical purposes.

For determining the amount of free hydrochloric acid, Mintz's method seems much the best. Töpfer's dimethyl-amido-azo-benzol may be used if one has made himself familiar with the shades of col-

oring and their significance. And Winter's method will give useful figures for H., though as a rule below the truth.

The personal factor in these examinations is of great importance. Experience on the part of the examiner, handiness, judgment, and the capacity for taking pains, affect greatly the value of the figures.

When practicable, two independent analyses of a specimen should be made, and no confidence should be placed in them unless they closely agree.

Strictness must be insisted upon in regard to the test-meal, freedom from dilution and from admixture of other material, and the moment of obtaining the specimen.

Analyses should be recorded with careful notes as to the details of methods used.

I shall not be able at present to go on to a discussion of the clinical significance of the laboratory findings; but I will append, for such as may be interested, some tables of analyses of gastric contents from certain groups of cases. There has been a free weeding out of such as bore either verbal confession or internal evidence of a non-observance of the desired conditions in obtaining them. In looking them over, such analyses must be eyed with some suspicion as show very low figures for the total acidity and the fixed chlorides.

TABLE VIII.—CASES OF CANCER, PROVED BY LAPAROTOMY.

	Method.	A.	H.	C.	H. + C.	F.	Remarks.
No. 258....	Winter	.110	.00	.015	.015	.233	Laparotomy. Cancerous infiltration of large part of stomach.
	Günzburg.....		Negative.				
No. 264....	Winter	.104	.00	.00	.00	.199	The same case.
	Günzburg.....		Negative.				
No. 270....	Winter	.734	.00	.018	.018	.233	The same case.
	Günzburg.....		Negative.				
No. 272....	Winter	.396					Not after a test-meal. Laparotomy. Circumscribed tumor of pylorus.
	Günzburg ..		Negative.				
No. 283....	Winter	.266	.00	.026	.026	.200	Diluted. Laparotomy. Growth involving entire anterior surface of stomach.
	Günzburg.....		Negative.				
No. 232....	Winter	.110	.00	.00	.00	.182	Laparotomy. Tumor of greater curvature of size of kidney.
	Günzburg.....		Negative.				

TABLE IX.—PROBABLY CANCER.

	Method.	A.	H.	C.	H. + C.	F.	Remarks.
No. 208....	Winter Günzburg	.305	.00 Negative.	.212	.212	.153	Aged forty; for eighteen months severe pain in epigastrium, independent of meals. For four months frequent vomiting, sometimes material like coffee-grounds. A mass felt in left side of epigastrium.
No. 213 ...	Winter Günzburg	.019	.009 Negative.	.049	.058	.109	Aged forty-six; eighteen months vomiting, pain, marked emaciation, and pallor. Liver hard and nodular. Elastic tumor in left hypochondrium. Died. No autopsy.
No. 248....	Winter Günzburg	.175	.014 Slight.	.095	.109	.153	Aged fifty-eight; in seven months has lost fifty pounds, three months vomiting. Liver large, hard, and nodular.
No. 251....	Winter Günzburg	.052	.00 Negative.	.00	.00	.196	Aged fifty-eight; pain in epigastrium, independent of meals; lost fifty pounds; later, blood in vomitus and stools. A mass felt in right epigastrium.
No. 286. ..	Winter Günzburg	.136	.00 Negative.	.087	.087	.073	Aged thirty-three; seven months frequent attacks of vomiting; lost fifty-three pounds. Liver enlarged.
No. 289....	Winter Günzburg	.325	.008 Faint.	.138	.146	.124	The same case.
No. 317....	Winter Töpfer Mintz .. Günzburg	.193	.052 .069, .120 .083 Marked.	.116 .029	.168 .098	.197	Aged thirty-eight; two years ago distress in stomach after meals; vomited a few times, once a cupful of dark blood. Later, severe pain after food or water; recovered after three months. Last four months, pain two or three hours after eating. No vomiting, stools black, emaciated, cachectic. Hard, tender mass in left epigastrium.

TABLE X.—CASES OF SECONDARY OR MODERATE INDIGESTION.

	Method.	A.	H.	C.	H. + C.	F.	Remarks.
No. 129....	Winter Günzburg	.045	.00 Negative.	.030	.030	.240	Uterine, neurasthenia.
No. 132....	Winter Günzburg	.091	.00 Negative.	.029	.029	.138	Cardiac.
No. 139....	Günzburg .....	.....	Negative...	.....	.....	.....	Hysteria. Recently confined.
No. 148....	Winter Günzburg	.429	.168 Marked.	.167	.335	.146	Neurasthenia.
No. 196....	Winter ... Günzburg	.422	 Marked.	.....	.146	.146	The same case.
No. 221....	Winter Günzburg	.273	.051 Marked.	.080	.131	.102	The same case.
No. 244....	Winter Günzburg	.313	.044 Marked.	.095	.139	.094	The same case.
No. 161....	Winter	.107	.036	.022	.058	.153	Moderate pulmonary symptoms.

TABLE X.—CASES OF SECONDARY OR MODERATE INDIGESTION (*continued*).

	Method.	A.	H.	C.	H. + C.	F.	Remarks.
No. 194....	Winter Günzburg....	.539	.080 Marked.	.226	.306	.124	Cardiac.
No. 195....	Winter Günzburg....	.500	.132 Marked.	.124	.256	.116	Neurotic.
No. 197....	Winter Günzburg....	.403	.139 Marked.	.066	.205	.138	The same case.
No. 211....	Winter Günzburg....	.576	 Marked.	.....	.....	.....	The same case.
No. 205. ..	Winter Günzburg ...	.143	.00 Negative.	.051	.051	.211	Moderate recurrent indigestion.
No. 214....	Winter Günzburg....	.014	.00 Negative.	.051	.051	.233	Diarrhoea.
No. 215...	Günzburg....	.....	Negative.	.....	.....	.....	The same case.
No. 226....	Winter Günzburg....	.058	.00 Negative.	.052	.052	.167	Grippe.
No. 230....	Winter Günzburg....	.032	.00 Negative.	.051	.051	.138	Irregular moderate indigestion.
No. 234....	Winter Günzburg....	.256	.015 Faint.	.117	.132	.138	Phthisis.
No. 243....	Winter Günzburg....	.406	.154 Marked.	.084	.238	.094	Neurotic.
No. 245....	Winter Günzburg....	.299	.036 Marked.	.131	.167	.146	The same case.
No. 265....	Winter Günzburg....	.409	.292 Marked.	.036	.328	.153	Neurotic.
No. 267....	Winter Günzburg....	.442	.018 Marked.	.175	.193	.138	The same case.
No. 274....	Winter Günzburg....	.468	.182 Marked.	.080	.262	.124	Tumor of head of pancreas.
No. 293....	Winter Günzburg....	.273	.029 Faint.	.080	.109	.210	The same case.
No. 288 ...	Winter Günzburg....	.065	.00 Negative.	.022	.022	.124	Recurrent attacks of epigastric pain.
No. 294....	Winter Günzburg....	.299	.00 Negative.	.131	.131	.159	Neurotic. For years attacks of epigastric distress and pain.
No. 296.1 ..	Winter Günzburg ..	.226	.00 Negative.	.087	.087	.239	The same case.
No. 296.2 ..	Winter Günzburg ...	.174	.00 Negative.	.138	.138	.210	The same case.
No. 315	Winter Täpfer Mintz..... Günzburg....	.138	.029 043, .083 .043 Good.	.088 029	.117 072	.138	Moderate chronic indigestion.
No. 294.5 ..	Winter Günzburg....	.260	.022 Faint.	.145	.167	.145	Neurasthenia, uterine.
No. 210...	Winter Günzburg ...	.117	.00 Negative.	.062	.062	.142	Chronic indigestion. Recent confinement.
No. 303....	Winter Täpfer Mintz..... Günzburg....	.149	.021 102 .051 Good.	.088 025	.109 127	.204	Malarial.

TABLE XI.—CHRONIC SEVERE CASES.

		A.	H.	C.	H. + C.	F.	Remarks.
No. 138....	Winter Günzburg ..	.539	.022 Marked.	.197	.219	.2c4	Not after test meal.
No. 142 ...	Winter Günzburg....	.370	.073 Marked.	.080	.153	.146	
No. 143....	Winter Günzburg....	.370	.091 Marked.	.139	.230	.167	
No. 144....	Winter Günzburg....	.279	.033 Marked.	.102	.135	.178	
No. 187 B..	Winter Günzburg ...	.279	Marked.				
No. 192....	Winter Günzburg....	.416	.047 Marked.	.105	.152	.219	
No. 193....	Winter Günzburg ...	.481	.109 Marked.	.166	.275	.189	
No. 202....	Winter Günzburg....	.260	Negative.				
No. 222....	Winter Günzburg....	.014	.00 Negative.	.008	.008	.138	
No. 227....	Winter Günzburg ...	.208	.014 Negative.	.041	.055	.134	
No. 228....	Günzburg....	.....	Negative.				
No. 283...	Winter Günzburg....	.162	.029 Fair.	.059	.088	.087	Diluted.
No. 284....	Winter Günzburg	.169	.00 Negative.	.036	.036	.153	Forty minutes after test-meal.
No. 295....	Winter Günzburg....	.266	.00 Negative.	.095	.095	.217	
No. 299 ...	Winter Töpfer Günzburg	.222	.025 Marked.	.153 .083	.178 .192	.225	
No. 300....	Winter Töpfer Günzburg....	.240	.043 Good.	.197 .043	.240 .195	.116	

TABLE XII.—SPECIMENS OBTAINED FROM THE SAME PATIENT AT DIFFERENT TIMES.

	A.	H.	C.	C + H.	F.		A.	H.	C.	C + H.	F.
No. 138.	.539	.022	.197	.219	.204	No. 256.	.071	.000	.036	.036	.102
No. 138, examined five days later.....	.....	.022	.270	.292	.204	No. 258, obtained ten days later.....	.110	.000	.015	.015	.233
No. 142, obtained four days later.....	.370	.073	.080	.153	.146	No. 264, obtained nine days later.....	.104	.000	.000	.000	.199
No. 143, obtained seven days later.....	.370	.091	.139	.230	.167	No. 270, obtained twenty-one days later....	.734	.000	.018	.018	.233
No. 144, obtained three days later.....	.279	.033	.102	.135	.178	No. 265.	.409	.292	.036	.328	.153
No. 148.	.429	.168	.167	.335	.146	No. 267, obtained one day later.....	.442	.018	.175	.193	.138
No. 196, obtained three months later.....	.422	.....	.....	.146	.146	No. 266.	.429	.022	.037	.059	.262
No. 221, obtained nine weeks later.....	.273	.051	.080	.131	.102	No. 268, obtained two days later.	.234	.058	.110	.168	.094
No. 244, obtained seven months later.....	.313	.044	.095	.139	.094	No. 274.	.468	.182	.080	.262	.124
No. 223.	.274	.008	.138	.146	.146	No. 293, obtained five months later.....	.273	.029	.080	.109	.210
No. 224, obtained one day later.....	.312	.029	.102	.131	.153	No. 279.	.227	.000	.102	.102	.087
No. 225, obtained one day later....	.201	.010	.063	.073	.153	No. 281, obtained three days later.....	.292	.021	.125	.146	.094
No. 188.	.377	.096	.182	.278	.116	No. 284.	.169	.000	.036	.036	.153
No. 198, obtained seventeen days later....	.533	.124	.167	.291	.110	No. 290, obtained five weeks later.....	.377	.007	.175	.182	.102
No. 195.	.500	.132	.124	.256	.116	No. 286.	.136	.000	.087	.087	.073
No. 197, obtained three days later.....	.403	.139	.066	.205	.138	No. 289, obtained sixteen days later	.325	.008	.138	.146	.124
No. 211, obtained twenty days later.....	.576	.....	.....	.....	.....	No. 294.	.299	.000	.131	.131	.159
No. 208.	.305	.000	.212	.212	.153	No. 296.1, obtained seven days later....	.226	.000	.087	.087	.239
No. 219, obtained twenty-four days later....	.351	.015	.160	.175	.102	No. 296.2, obtained seven days later....	.174	.000	.138	.138	.210
No. 223, obtained one day later.....	.274	.008	.138	.146	.146	No. 299.	.222	.025	.153	.178	.225
No. 224, obtained one day later.....	.312	.029	.102	.131	.153	No. 300, obtained four days later.....	.240	.043	.197	.240	.116
No. 225, obtained one day later.....	.201	.010	.063	.073	.153						
No. 243.	.406	.154	.084	.238	.094						
No. 245, obtained four days later.....	.299	.036	.131	.167	.146						

IV.

CONTRIBUTION TO THE SURGERY OF THE PELVIS OF THE KIDNEY.

BY CHARLES K. BRIDDON, M.D.

THE literature of the operative surgery of the kidney is replete with histories of cases that have baffled the most experienced operators, and although the inestimable advantages of aseptic surgery have inaugurated the institution of explorations that were not considered proper in the preceding period, there can be no doubt that much remains to be done in this department.

Even now, when the searching scrutiny of the pathologist has forced nature to yield many of the deviations of her natural secret processes, history affords ample illustrations of the almost insuperable difficulties with which the clinician has frequently to contend, and the mortification which he has often to endure in his operative work, when confronted with conditions other than those predicted, at the bedside. These revelations have, however, undoubtedly added to our store of knowledge, and by their accumulation have made possible many of the most brilliant achievements of modern surgery.

The safety with which such explorations are now made on the living subject, may have, and in all probability has, led to their too frequent use, and their fascination may have induced the enterprising operator to neglect the time and pains that, in times gone by, would have been taken to establish a previous diagnosis. Such procedures on the living only too often fail to throw light on the obscurer cases, and are only warranted when the physician has used up all the resources of his art; then, and then only, is it the province of the surgeon to expose the parts to view.

Confining ourselves to the interesting subject of the present paper, it may be proper to insist that it in no way detracts from the value of an operation when we fail to find what we had expected,

in those done for exposing the kidney and its pelvis. As quoted by Henry Morris, in 1884, there was a record of twenty-four operations for stone where none was found, and, referring to the difficulties occasionally encountered in such cases, the same author cites a case of Knowsley Thornton's in which the symptoms pointed to the presence of calculus in one kidney, and in which the combined operation through abdomen and loin proved its existence in the other. Such cases could be multiplied to a wearisome extent, and they are not alluded to for the purpose of extenuating the error in the diagnosis of one of the present cases, because in it there were found lesions that could not possibly have been made out without exploration; and the following history is drawn from the records of the hospital:

CASE I. I. C., aged twenty-two; single; stone-cutter; United States. On admission gave the following account of himself: Has been a man of temperate habits; never any evidence of rheumatism, malaria, syphilis, tuberculosis, or gonorrhœa; has always enjoyed good health, excepting the complaint for which he seeks relief, which began four years ago, and consisted in paroxysms of severe pain, principally in the lumbar region, vomiting, and slight disturbance of micturition; each paroxysm has been preceded by a chill, headache, constipation, and a coated tongue; four or five hours after the chill he is seized with vomiting, and severe pain, which is situated behind in the right lumbar region, and gradually passes around to the front of the abdomen, downward, terminating near the umbilicus. The pain has never passed down into the inguinal region, nor has there ever been retraction of the testicle. The pain is so severe as to double him up at times, and is accompanied by severe vomiting of all ingesta, lasting through the attack; micturition is difficult, and the urine seems diminished in amount; but he has never passed gravel or blood, nor suffered from sudden stoppage of the flow. During the first year the paroxysms came at intervals of about two months, and lasted from eight to ten hours; they have gradually increased in frequency, duration, and severity, and during the past year they have occurred nearly twice a week, and have lasted about thirty-six hours. No treatment has had any effect upon them but the administration of morphia. His last attack began in the evening of August 23, the day before he was admitted to the Medical Division of the hospital, service of Dr. Tuttle, under whose

careful and painstaking observation he remained for eleven days. During this time he had two attacks of severe pain, relieved only by the hypodermic administration of morphia. Examination repeatedly of the urine showed it to be slightly alkaline, with some amorphous phosphates, but no blood, pus, or casts. On admission palpation revealed an indistinct enlargement of the right kidney, which was also tender; the swelling, however, rapidly disappeared, and could not be recognized again. A diagnosis of probable renal calculus was made, and an operation advised, to which the patient readily consented, being willing to submit to anything that offered a possible chance of relief to his suffering. Accordingly, on September 4, he was transferred to the Surgical Division, where he was under observation for four days, in which time he had one attack, which resembled, in all its features, those which had been noted before.

September 8. After the usual preliminary preparation, ether was administered. Patient was placed in the ventral position, with a moderate-sized sand-bag under the lower abdomen, to enlarge the ileocostal space. Incision posteriorly four inches to the right of the vertebral spinal processes, vertical, reaching from just below the twelfth rib to the crest of the ilium, along the outer border of the erector spinæ. Lumbar aponeurosis exposed and divided, disclosing quadratus lumborum and peri-renal fat, which was separated sufficiently to expose the whole kidney, in front as well as behind. In appearance it was perfectly normal, and palpation between the four fingers in front and the thumb applied to its posterior surface detected absolutely nothing. The pelvis of the kidney was next exposed by pressing away the fat from its posterior surface, when it ballooned up into the wound, dilated up to about the size of a small lime, its prominence and collapse being influenced by the movements of respiration; its walls, bluish-gray in color, resembled somewhat the tense walls of a small ovarian cyst; the ureter, which was considered to be slightly larger than normal, and its implantation into the hilum, a little above the centre, was somewhat obscured by the dilated pelvis bulging over it, but the slightest pressure with the finger sufficed to press this away, and exhibit its communication with the pelvis. The ureter was traced down for several inches, and no stone found. The pelvis was then opened by a longitudinal incision one inch and a quarter in length, giving exit to about one ounce of clear urine. A finger introduced through

this opening could pass freely into all the calyces, with negative result. The walls of the pelvis only moderately thickened. A vertebrated probe was then passed down the ureter to its entrance into the bladder, and upon its withdrawal an elastic catheter, 10 F., was readily passed into the bladder, giving exit to urine. No calculus was found, and in the absence of any other obstruction—unless the bulging of the lower half of the pelvis could be considered such—the incision in the hilum was closed by a fine, continuous catgut suture, the remainder of the wound being closed around an iodoform-gauze drain, the patient leaving the table in excellent condition.

The next morning after the operation the patient had a slight attack of pain resembling his previous ones, which lasted only one hour, and this was the only attack he had subsequent to the operation. Convalescence was uneventful; at no time was there any evidence of leakage of urine. For four or five days there was a free discharge of blood-serum, which required a daily change of the superficial gauze. The drain was changed on the fifth day and a shorter one used. On the tenth day it was removed entirely. He was allowed to get up on the fourteenth day, and left the hospital on September 20, cured. I saw him again on November 1 and he had suffered no return of pain. I have again seen him to-day, December 8, and no return.

Remarks.—This patient was in the Medical Department of the hospital during two of his paroxysms, and very careful observations were made to differentiate between nephro- and cholelithiasis; the pain always began in the right lumbar region, passing round to the front, nearly to the umbilicus, to the right of which A. W. Mayo Robson states that there is always a tender point to be found in the latter affection when associated with gall-bladder inflammation. This tender spot is to be found at the junction of the upper two-thirds, with the lower third of a line drawn from the ninth rib to the umbilicus. The pain in this instance radiated in this direction, and not downward to the inguinal region. He had never noticed retraction of his testicle, nor had he ever passed blood in his urine. These conditions warranted a careful consideration of the possibility of the attacks being due to the passage of calculi, blood-clots, or inspissated mucus, or bile through the cystic duct. There had been no evidence of obstruction in the common duct; he had never ex-

hibited any symptoms of obstructive jaundice. On the other hand, the pain always began in the lumbar region, which was very sensitive to pressure, especially to a sudden tap, and had always been associated with, or followed by, difficulty in micturition. During one of the attacks that were observed in the Medical Ward it was thought that there was slight enlargement of the kidney, but this was not found on any subsequent occasion, and the repeated and careful analyses of urine were negative, unless its slightly alkaline condition could be considered an element in diagnosis. After a careful consideration of all these facts there existed no hesitation in accepting the judgment of the physician in charge—that the case was one of renal colic, and probably due to stone.

The conditions found on exposing the kidney, though not entirely satisfactory in confirmation of the diagnosis, were extremely interesting; and though familiar with the admirable paper on the surgery of the ureter, by Christian Fenger, of Chicago, and that of Mynter, of Buffalo, on valvular distortions of the same, I could scarcely satisfy myself that the dilatation of the hilum was sufficient to cause obstruction. It was noticed that the lowest part of that cavity was more dilated than the upper, making it appear as if the ureteral implantation was higher than normal. In passing the catheter I found it necessary to direct its point upward, so as to engage its point in the ureter, and then had no difficulty by rotating the instrument on its transverse axis in introducing it into and through the canal. It evidently had to surmount a ridge formed by the bulging of the lower half of the pelvis, still the obstruction, if this condition really constituted one, was apparently so slight that I was not prepared to accept it as a causative agent at that time, realizing, however, that in the future an increase in the dilatation might cause one of those valvular conditions described by the authors previously referred to. Of course it is possible a calculus might have passed during the attack of the previous day, or that one engaged in the ureter might have been pushed into the bladder by the catheter, but the facility with which that instrument passed would preclude any such conclusion, and no evidence of it having passed into or out of the bladder was obtained. With considerable misgiving as to whether I had found the real cause of these attacks, I closed the opening in the pelvis with a fine, continuous gut suture, bringing the remainder of the wound together around a drain.

I must confess that I was very much and agreeably surprised at the result in this case, as I was not prepared to expect it. On the morning following the operation he had an attack of pain resembling his old ones, but lasting only one hour, and in all probability due to the passage of a small clot of blood, since which he has been absolutely free from pain.

CASE II. *Intermittent Hydronephrosis. Plastic Operation on Origin of Ureter from Pelvis of the Kidney.*

F. G., aged seventeen; single; school-girl; United States.

History.—Negative up to six years ago, when she began to have attacks of pain in the right lumbar region. She has had from two to three attacks each year for three years. These attacks generally came on when she was up and about, and confined her to bed for about three days. The pain was not very severe, and always subsided after the application of heat. Menstruation has always been normal; has been constipated for a long time past. One year ago she was sick one month with what her physician says was fecal impaction. During the past eight months she has had three attacks of pain in the right lumbar region, associated with the appearance of a tumor, which always disappeared with the pain after a short time. The first attack began April 15, 1897, on which day she was admitted into the Presbyterian Hospital. The pain was situated about midway between the right costal arch and the crest of the ilium, about two inches to the outer side of the mammary line, and passed backward to the spine. It was constantly present, sharp in character, but of varying intensity. The pain at times "doubled her up," and was associated with sweating and chills. She vomited but once. On the second day of the attack a large, soft tumor appeared in the locality of the pain. The pain appeared to increase as the tumor became larger, and gradually abated as the tumor disappeared, about ten days later. Examination of the urine was negative. She was discharged April 16 with diagnosis of hydronephrosis. The second attack was two weeks ago. The pain was very slight; it appeared in the evening and she felt a tumor as before. On the next morning both the pain and the tumor had disappeared. Noticed no increased amount of urine at the time the tumor disappeared. The present attack began November 28, one day previous to admission, with pain in the same locality as in the two previous attacks and the reappearance of the tumor. At no time has she ever been

jaundiced. The pain has never radiated downward into the groin; there has never been any disturbance of urination. She has never noticed any change in the quantity or quality of urine in connection with the appearance and disappearance of the lumbar tumor. On admission physical examination showed the patient to be well-nourished though slightly anæmic. Heart apex in fifth space just inside mammary line; apex-beat localized, forcible and regular. At apex is a harsh, very loud systolic murmur, transmitted around into axilla, heard all over præcordium and over back. Lungs are normal. Liver percusses from fourth space to free margin; edge not felt; abdomen is not distended. Occupying the middle of the right side of the abdomen, at level of umbilicus, is felt a tumor about the size of a small cocoanut. Palpation shows the tumor to extend to the median line internally and from level of anterior superior iliac spine below to costal arch above. The tumor is tense, elastic, fluctuating, somewhat tender and slightly movable. Tumor is easily felt, occupying the whole right lumbar region, by bimanual palpation. An impulse given to tumor in front is transmitted through tumor and easily felt by hand behind. Percussion over tumor is dull, with tympany between tumor and the liver edge.

Operation.—Vertical incision outside the erector spinæ, reaching from the last rib to near the crest of the ilium. The quadratus lumborum was drawn inward, bringing into view the vertebral aponeurosis, the division of which exposed the peri-renal fat, which was displaced sufficiently to clear the surface of the kidney, which at this point was apparently healthy; further blunt dissection brought plainly into view an enormously dilated pelvis. In the endeavor to find it, a pretty tight band was found stretching across the ureter, about one inch and a half below its supposed termination. It looked like nerve-tissue, and a small vessel could be felt pulsating within it. To expose the ureter below it was found necessary to divide this band between two ligatures. This freed the parts sufficiently to trace the somewhat convoluted canal up to its union with the pelvis. A longitudinal incision one inch and a half long was then made in the pelvis, giving exit to about twelve ounces of dark-colored urine. The finger introduced into this opening came everywhere into contact with the inner wall of a large sac, the extreme limits of which, however, could not be reached; all but one of the lower calyces were effaced, but the main distention appeared to be in the pelvis itself.

The incision was held apart with blunt hooks sufficiently to expose the ureteral opening ; the upper half of this was funnel-shaped, the lower half appeared to be valvular ; the valve being formed by a spur-like eminence caused by the juxtaposition of the dilated pelvis and the ureter immediately below. No calculus was found anywhere, and to determine its absence in the ureter a catheter was passed through the pelvic opening into the bladder, giving exit to urine from that viscus. Supposing that the spur formation was the initial obstruction, and that the stenosis was then increased by the occlusion caused by the dilated pelvis pressing upon the walls of the canal immediately below, a plastic operation was done, the spur was divided to the extent of three-quarters of an inch, and the margins of the incision were secured with half a dozen gut sutures. The opening in the pelvis was then closed by continuous suture of the same material. The kidney was anchored by passing three stout catgut sutures through the capsule and parenchyma of the organ, the lumbar fascia and the overlying quadratus. A gauze drain was passed down to the line of sutures in the pelvis, and the upper portion of the superficial wound was closed.

There was nothing to record in the after history of this case, save that it was uneventful ; there was absolutely no leakage of urine from the wound, the greater part of which healed "per primam," cicatrization being complete by the end of December, when she was discharged.

Of course it is not meant to put this case on record as a cure of so intractable a disease as intermittent hydronephrosis, but only as illustrating in that direction the possibilities of conservative surgery

V.

A CONTRIBUTION TO THE STUDY OF THE BACTERIOLOGY OF THE BLOOD IN DISEASE.

BY WALTER B. JAMES, M.D.,

AND

GEORGE A. TUTTLE, M.D.

SINCE the earliest days of the science of bacteriology many efforts have been made to discover micro-organisms in the blood of living persons, in order to explain, by their presence there, the phenomena of disease, or to use their discovery, in this situation, as an aid in differential diagnosis.

The finding of the plasmodium malariae by Laveran, with the great benefits that have resulted from this knowledge, and the demonstration of many forms of hæmatozoa in the lower animals and in men, have added zest to this inquiry, proving, as they do, that some micro-organisms at least may live and thrive in the blood of living persons. Moreover, the frequency with which metastases occur in many bacterial diseases indicates the importance of this tissue as the carrying-agent of infectious material. To be sure, it is fairly well proved that in the infectious diseases the characteristic symptoms are brought about by the presence in the blood of the chemical life products of the micro-organisms rather than by the bacteria themselves, yet, in some cases at least, these latter do succeed in getting into the blood current, and it is certainly desirable that their relation to it should be investigated and understood as clearly and as thoroughly as may be possible. But up to the present time, however, the existence of bacteria in living blood has not been demonstrated satisfactorily enough, nor have the methods of clinical investigation in this direction been so easy of application as to develop any considerable amount of confidence on the part of the profession in these procedures. Widely different results have been obtained by different workers in this rather limited field, and widely different conclu-

sions have been reached as the result of the various experiments made. Most of the investigations have been made by Germans, whose zeal in this particular department of bacteriology has been amazing. Differences in the conclusions reached have been the result, probably, of the various frames of mind in which the subject has been approached, as well as of the differences in the methods that have been employed in obtaining the blood and in examining it for bacteria; for example, Meisels,¹ in 1886, reported the examination of blood in nine cases of typhoid fever, in every one of which he claims to have found the typhoid bacilli, while Stagnitta,² in 1890, examined fourteen cases, all with negative results.

Of course the element of chance may enter into the production of these varying results, but the wide differences in the trustworthiness of the methods employed in the investigations suggest that these, for the most part, are responsible for the discrepancies.

First, as regards the method employed in obtaining the specimen of blood for examination: Some observers have pricked the finger-tip with a sterilized needle, the skin having previously been more or less carefully washed and attempts made to render it sterile.

A drop of blood is then expressed and used for the purpose of the experiment.

Others have used a sterilized wet cup, the skin having first been carefully cleansed, and in this way they have obtained blood in considerable quantities. Manifestly, the chance of contamination in using the above two methods is so great that the results obtained in these investigations cannot be regarded as worthy of confidence.

It is practically impossible to render any considerable area of the integument sterile, and so it is a significant fact that in a strikingly large number of the experiments that have been carried out by these methods, positive results have been obtained, and bacteria have been found in the blood.

Scheuerlen drew one end of a glass tube to a fine point, stopped the larger end with cotton, and then sterilized it. Immediately before being used the small end was broken off and the point of the tube then thrust into one of the superficial veins of the forearm, the skin having first been disinfected. The blood flowed into the tube by its own pressure, and could be blown out again at will. This method is certainly one of the most reliable of those that have been suggested, as far as danger of contamination is concerned, but the forc-

ing of the sharp end of the broken glass through the skin and into the vein must surely be a difficult procedure and not without much discomfort and, possibly, danger to the patient.

Scheuerlen, as the result of his experiments thus carefully carried out, claims that in health the blood is free from micro-organisms, but that in inanition and immediately before death they may be present in it.

A large number of investigators have made use of a sterilized hypodermic syringe, the needle being thrust directly into the vein, and in this way a fair quantity of blood is obtained.

This method is probably as nearly free from objections as any that can be devised, provided the syringe is sterilized with sufficient care; and if the procedure is properly carried out the number of contaminations will be reduced to a minimum. But the objections to the employment of the syringe are practical ones, and are sufficient to prevent its use for this purpose from becoming general.

In the first place, it is rather difficult to sterilize a hypodermic syringe; moreover, after frequent use in this way the piston becomes disordered, and, finally, the expense of keeping on hand a sufficiently large number of syringes is considerable.

During the past year, at the Presbyterian Hospital, it being desired to make a large number of tests of the blood for bacteria in different diseases, a simple and inexpensive substitute for the hypodermic syringe was devised, which proved so satisfactory that it seems worth while to describe it in detail.

A piece of glass tubing about $4\frac{1}{2}$ inches in length and $\frac{1}{4}$ inch in diameter is drawn to a taper at one end and ground to fit the cap of a rather fine short hypodermic needle. The larger end of the tube having been stopped with a cotton plug, the whole is then placed in a larger glass tube and both ends of this are similarly stopped with cotton.



The apparatus is sterilized by dry heat. In using it, the inner tube with needle attached is removed, the skin over one of the most prominent veins on the anterior surface of the forearm, near the

bend of the elbow, is selected, a piece of rubber tubing or a few turns of a bandage being passed around the arm above with moderate pressure, in order to produce distention of the vessels. The needle is thrust into the vessel and generally blood begins to flow at once into the tube. As a rule, the latter will not entirely fill by the blood-pressure itself, but any quantity desired may be obtained by making gentle suction, either by applying the mouth directly to the end of the tube where it is stopped with cotton, or through the medium of a small piece of rubber tubing slipped over it.

Attempts to produce suction by means of a syringe or bulb have proved much less satisfactory than when the mouth-suction was employed.

By the above described instrument, vein punctures have been made in about one hundred and fifty cases of a variety of diseases. At no time was any difficulty experienced in obtaining the amount of blood desired, which was generally about 1 c.c. In a few instances it was necessary to try two punctures before securing a free flow through the needle; in no case was there any local reaction whatever at the seat of puncture, nor did the patient complain of pain or annoyance.

Considerable attention has been given to the determination of the best method of securing disinfection of the skin before making the puncture. The method selected and used in almost all of the cases here recorded, has been as follows:

The bend of the elbow and the integument for a considerable distance above and below it are first thoroughly scrubbed with soft soap and water, this being washed off with sterilized water. It is then washed with alcohol and ether, after which a wet bichloride dressing is applied and left in place for several hours. The specimen of blood when drawn from the vein was at once distributed among from three to ten tubes of coagulated blood-serum and sent to the Pathological Laboratory. In some cases the number of implantations was limited by the early coagulation of the blood in the tube, making it in this way impossible to force it through the needle. But, as a rule, this did not constitute a considerable difficulty. Where it does occur, it is readily overcome by having a sterilized thumb-forceps at hand, by which the needle can be removed from the tube, and so the full calibre of the tube opening made available for removing the blood.

The instrument after use is washed with water, to prevent clogging of the needle by the coagulated blood, and it is then sterilized. In this way it may be used over and over again. It is very easily manufactured, and a dozen may be obtained from the instrument-maker for about the same price as one good hypodermic syringe.

The number of contaminations in the specimens of blood obtained by the above method was relatively small, and it is believed that the results as published may be considered as fairly indicative of the condition of the blood in the cases selected at the time when the punctures were made.

Kühnau³ believes that he secured diminished risk of contamination by first dissecting out the veins before puncturing, rather than by thrusting the needle through the skin; it is our opinion, however, that this is not necessary. If a small needle is used and the point is well sharpened, the chances of carrying bacteria into the vein and from there through the needle back into the tube must surely be almost infinitesimal, and probably at least no greater than when Kühnau's more or less complicated procedures immediately precede the puncture. Moreover, the percentage of contaminations in our cases is much smaller than in his. We believe that those that have occurred were for the most part the result of faulty manipulation of the blood or of the tubes, and that by additional experience and increased care they can be reduced to a minimum. Moreover, the dissecting out of the vein is surely not entirely free from danger, and must in many cases be very unpleasant for the patient.

It was our object to find a method which should admit of ready and easy application, as a part of ward routine work, and which should be entirely devoid of danger to the patient.

If the present method of investigation is to be made available for general clinical use, the paraphernalia and the procedures must be simple enough to be applied by the house-staff of a hospital, or by any practicing physician at the bedside. The method used in cleansing the skin, as above described, has been made as thorough as possible, in order that the results obtained in the present investigation might be as free as could be from the reproach of being vitiated by contaminations. But it is our opinion that if the skin be thoroughly washed with soap and water and then with alcohol, the danger of accidental impurities getting into the tube is so small that

it may fairly be disregarded, and that in ordinary clinical investigations the more or less laborious procedures above described may safely be omitted.

Also, our object in using tubes, instead of plates, for our cultures, was to the same end. The latter would require in every case the presence and aid of a skilled bacteriologist, with more or less complicated apparatus for heating, etc., while with very little practice the house-staff have learned to quickly and safely transfer the blood to the tubes in a perfectly satisfactory manner.

When we come to look into the methods that have been used in studying the specimens of blood obtained in these various ways, we find that they are of all degrees of thoroughness.

In searching the blood for bacteria, some observers have depended upon microscopic examination of cover-glass preparations stained in various ways. The possible sources of error in this method are obvious. The difficulty in keeping cover-glasses, slides, and staining fluids absolutely free from micro-organisms, either living or dead, together with the physical impossibility of searching through any considerable quantity of blood for so small objects as bacteria, make the reports of findings by this method entirely undeserving of confidence. Most investigators have made agar or gelatine plates with the blood obtained, and where a growth has occurred have studied the colonies. In a few cases (Kühnau³) animal inoculations have also been carried out, but generally only with the colonies developing in the plates, and not with the fresh blood itself. The most satisfactory series of investigations that have been made along this line are those of Kühnau; he has studied with the utmost care and detail the blood of a very large number of cases of various infectious diseases.

His methods as described are above reproach.

He obtained blood in most cases by laying bare with a scalpel a vein of the forearm, as has already been described. The specimen secured was then added to melted agar bouillon and poured in plates. Where a growth developed, the colonies were counted, the micro-organisms were differentiated in the most thorough way, and inoculations in animals carried out.

Not the least interesting and valuable part of Kühnau's paper is taken up by a description of the results of a study of blood obtained by finger-tip puncture from the cases in which he had already

made vein punctures. Although the finger was always carefully washed and attempts were made to thoroughly sterilize it, yet in a very large proportion of the cases, amounting at times to ninety per cent., growths of various bacteria were obtained, generally of streptococci. The same cases examined by vein puncture gave negative results, although a very much larger amount of blood was used. These experiments prove fairly conclusively that the method of simple skin puncture is so unreliable that it should be entirely abandoned.

Some observers have made cultures from the blood taken from the veins after death. But it is unsafe to draw from these results definite conclusions as to the condition of the blood during life, unless the experiment is made at a much earlier period after death than that at which autopsies are generally performed, as probably bacteria begin to propagate in the tissues, and especially in the blood, with great rapidity as soon as the patient dies.

In the present investigation the tubes inoculated at the bedside as described, are sent at once to the laboratory. If the blood has not been spread over the entire oblique surface of the blood-serum, a sterilized platinum wire is used for this purpose. Generally, however, there are a few drops of serum at the bottom of each tube, and by shaking and tapping the tube against the hand, the blood is diluted and spread over the surface without again opening the tube. It is important not to use too much blood. Three to four small drops in each tube are sufficient. The use of a larger quantity increases the chance of a bactericidal action of the blood coming into play to hinder the growth of any bacteria that may be present in it. The specimens are then placed in the incubator and examined daily for seven days, when, if no growth has appeared, they are assumed to be sterile. Most of the tubes, however, have been kept for from ten days to two weeks. When a growth has occurred, it has been, with few exceptions, in the shape of isolated colonies, and the exceptions have been contaminations with rapidly spreading bacteria from the air. The different colonies are examined separately, and when from their growth, color, and microscopical appearances they are not plainly saprophytic contaminations, they are plated in gelatine, and subjected to repeated staining, microscopical, and cultivation tests to establish their identity. In the case of the typhoid bacillus (found three times), it has been compared with a known

specimen of this bacillus in pure culture, and has shown the following properties :

1. It is actively motile.
2. It does not liquefy gelatine.
3. It does not coagulate milk.
4. It does not produce indol.
5. It does not produce fermentation, with gas formation.
6. With a tested specimen of blood from a case of known typhoid fever, it gives the Widal reaction in a characteristic manner.

The other pathogenic organisms found also have been subjected to all staining, microscopical, and cultivation tests to identify them, but no animal inoculation tests have been applied. These are the pyogenic cocci ; streptococcus pyogenes (4 times), staphylococcus pyogenes aureus (once), staphylococcus pyogenes albus (4 times), and the micrococcus lanceolatus (4 times). Among these, the staphylococci, both the aureus and the albus, are reckoned as contaminations.

The bacillus coli communis (found once) is also considered a contamination. This bacillus was found in a case of typhoid fever. It was distinguished by its production of indol, coagulation of milk, and fermentation with evolution of gas, together with other growth characteristics.

The non-pathogenic organisms found have been such as to require but little study. The bacillus subtillus has been found five times, a sarcina four times, a yeast once, and a very large coccus (not identified) once. These contaminations, with one or two exceptions, have affected only one tube in the series in which they occurred. In comparison with the entire number of tubes used, the contaminations form but a very small percentage. This fact attests the great care and skill exercised by the house-staff in obtaining the specimens, and lends a greater value to the positive results.

In tabulating the cases, and the results that have been obtained in them, it has been thought best to group them according to diseases, taking up each set of cases separately.

SEPTIC DISEASES.

Sittman examined the blood of 53 cases of septicæmia.

In 23 of them he found bacteria.
“ 11 “ “ staphylococci.
“ 4 “ “ streptococci.
“ 6 “ “ pneumococci.
And in 2 a variety of other bacteria.

He concludes that the examination of the blood is helpful in the diagnosis of septic conditions.

D'Espine and Marignac⁴ took a drop of blood from the finger-tip of a patient with scarlatina and isolated from it a streptococcus, which, when injected into mice and rabbits, was not virulent.

Bommers,⁵ in a very acute case of osteomyelitis, four hours before death, took a drop of blood from the finger-tip, made cultures, and obtained a growth of staphylococcus pyogenes albus. The fact that the blood was obtained from the finger-tip, together with the fact that in a case of malignant septic disease only that pyogenic bacterium was found which is generally the least virulent of all the pyogenic organs, makes it seem probable that his result was an accidental contamination from the skin.

Cannon⁶ has conducted an extensive series of investigations of this kind. He examined the blood both from living individuals and from dead bodies in cases of sepsis. The blood was taken, in some cases, from a vein in the arm; in other cases, from the finger-tip.

He found the staphylococcus pyogenes albus in 3 cases.
“ “ “ “ aureus “ 2 “
“ “ streptococcus “ “ 7 “
“ “ micrococcus lanceolatus “ 1 case.

He believes that he obtained very few contaminations. As the result of his investigations he concludes that in most cases of sepsis the micro-organisms, which are the cause of the disease, are present in the blood and can be demonstrated there. He believes that the examination is of much value, both in diagnosis and prognosis, and that the demonstration of the bacteria in the blood renders the prognosis less favorable. But a careful review of the methods which Cannon pursued develops the conviction that his results are not to be relied upon.

Avetrani⁷ claims that the search for the staphylococcus in the blood is of much use both in the differential diagnosis and in the prognosis of septic diseases. He finds that the prognosis is much affected by the character of the staphylococcus obtained. He examined four cases; in two of them he found the staphylococcus pyogenes albus, and both cases recovered. In the other two cases he found the staphylococcus pyogenes aureus, and both proved fatal. His method, as described, is thorough. He makes use of a hypodermic syringe, previously sterilized, the needle of which was inserted into the median basilic vein; 10 c.c. of blood was withdrawn and sown upon broth and agar.

Kühnau, in the very admirable investigation which has already been referred to, describes twenty-three cases of severe septic diseases from which he obtained blood. Nineteen of the cases were fatal. Twice he obtained the streptococcus pyogenes, once the staphylococcus pyogenes aureus. The number of colonies was in every case small, being from four to eight. In the first two cases the blood yielding the positive result was withdrawn a short time before the death of the patients; in the third case, during a chill. All other examinations from these same three patients were negative. The remaining twenty cases always gave negative results. On five occasions contaminations were present.

In the present investigation cultures were made from six cases of septic disease, two of them being mild and going on to recovery; the remaining four very severe, and all of them fatal. In the two mild cases no bacteria were found. Of the four severe cases three were puerperal fever, the other a very rapid and intense septicæmia, apparently having its origin in a suppurative inflammation of the middle ear, and going on to a fatal termination in nine days.

In two of the cases of puerperal fever, the streptococcus pyogenes was found. In one of them the result was confirmed by cultures made from the various organs at the autopsy. In the remaining two cases no growth was obtained from the blood during life, and, after death, attempts to obtain cultures from the organs were unsuccessful.

From a careful study of the cases recorded by others, and of those mentioned in this paper, we have arrived at the following conclusions:

1. That in the septic diseases in a large percentage of the cases,

SEPTIC DISEASES.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method of Obtaining Specimen, and Date.	Result of Culture.	Remarks, Course, Duration, and Result.
1. Walsh....	71, f.; 30; housewife.	Confined eighteen days ago, chill on sixth day after. On admission, pulse, 110; resp., 40. Left femoral phlebitis; cellulitis of forearms.	Vein puncture. May 11, '97.	Streptococcus pyogenes.	Delirium; temp., 105° F.; pulse, 160; resp., 50. Typhoid state. Death on fourth day. Streptococcus pyogenes also obtained by culture from a bleb on the foot.
2. Welch.....	251, f.; 34; housewife.	Miscarriage at third month, chill three days after. Vaginal discharge, foul. Temp., 104° F.; pulse 130; resp., 24.	Vein puncture. June 25, '97.	No growth.....	In hospital twenty-five days. Cured. Some foul fragments removed from uterus with curette. Temp. fell to normal on fifth day.
3. Whittle....	368, f.; 23; housewife.	Chills, fever, sweating. Great prostration. Temp. very irregular, like that of pyæmia, 99° or 100° to 104° or 105° F.	Vein puncture. July 14, '97.	No growth.....	In hospital one hundred and five days. Died. Anti-streptococcus serum used without benefit. Autopsy showed thrombi in iliac, and inferior vena cava and portal veins.
4. Dewfall....	Second examination. Third examination. 240, f.; 22; housewife.	About three weeks after confinement began to have chills, fever, and sweating. Cough, with profuse expectoration. Spleen easily palpable. (Edema of left foot and ankle; severe pain in left thigh and leg. Temp., 103-5.5° F.; at times, 106.5° F.; pulse, 130-40; resp., 30-40.	July 24, '97..... Aug. 17, '97..... Vein puncture. June 25, '97.	No growth. No growth. Streptococcus pyogenes.	Cultures at autopsy from different organs gave no growth. In hospital eighteen days. Died. Autopsy showed iliac thrombosis and broncho-pneumonia.
5. Monginnet...	Second examination. 413, f.; 29; servant.	Endometritis, with repeated hemorrhages; chills, fever, sweating. Marked anaemia; curettement. Temp. irregular, 102-3° F.; pulse, 100-12; resp., 24.	July 3, '97..... July 8, '97..... Vein puncture. July 26, '97.	No growth. No growth. No growth.....	Cultures at autopsy from spleen and liver showed an abundant growth of streptococcus pyogenes. No other bacteria found. In hospital thirty-nine days. Cured. Temp. subsided after curetting the uterus.
6. Schlenker..	958, m.; 47; laborer.	Very severe headache for twelve days. Temp. high and irregular; delirium; right shoulder and elbow swollen and tender; petechiae on trunk and extremities. Temp., 105-6.8° F.	Vein puncture. Jan. 5, '98.	No growth.....	Temp. before death, 109° F. Died on ninth day. Autopsy showed suppurative otitis media and interna, and suppurating subdeltoid bursitis. Smears of pus from both places showed streptococci. Brain, thoracic and abdominal organs negative. Cultures from the organs, negative.

the bacteria that are the cause of the disease can be cultivated from the blood during life.

2. That the procedure described is of considerable value as an aid in the differential diagnosis of septic disease from other disorders simulating it.

3. That probably the bacteria are most apt to be found in the most severe cases.

4. That it is possible to cultivate the bacteria from the blood in cases which show no evidences of metastatic inflammations.

5. That the discovery of the bacteria in the blood renders the prognosis more grave.

RHEUMATISM.

The etiology of acute articular rheumatism is still entirely undetermined, but the impression is constantly gaining ground that it must be classed among the acute infectious diseases. Also its clinical phenomena point to the probable existence in the blood of the *materies morbi*. The shifting character of the pains, the rapid involvement of the joints one after the other, all suggest from a clinical stand-point that the poison, whatever it may be, is carried throughout the body by the blood-current.

Numerous observers have found bacteria associated with the lesions of acute rheumatism, but as a rule there have been the well-recognized pyogenic varieties, streptococci or staphylococci. It has not yet been possible to connect the disease itself with these latter as an etiological factor.

The experiments that have been made in searching the blood of rheumatic persons for bacteria, have not yielded any satisfactory positive results.

Kühnau,³ in his investigation, sowed blood from sixty-seven cases of acute articular rheumatism, and in only one case obtained a growth, this being of the *staphylococcus pyogenes aureus*.

In the present investigation the blood was examined in twenty cases of rheumatism of varying degrees of severity. In one case a single colony of the *staphylococcus pyogenes albus* developed in one tube, and was regarded as an accidental contamination. In all of the remaining nineteen cases no pathogenic organisms were found.

Consequently, we conclude that up to the present, bacteriological examination of the blood has thrown no light upon the etiology of acute articular rheumatism, and is of no clinical value in it.

RHEUMATISM, ACUTE ARTICULAR.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
7. Cusick.....	198, f.; 31; domestic.	Pain and swelling of left knee. Some fluid in joint. Temp., 100-2.5° F. There is also a suppurating prepatellar burstis.	Vein puncture. June 14, '97.	No growth.....	In hospital twelve days. Improved.
8. Baleman....	M.; 41; engraver..	Five days ago pain began in right ankle, then in left, then in both knees. Joints swollen and red. No cardiac complication. Temp., 101.5° F., soon falling to normal.	Vein puncture. June 17, '97.	One tube contaminated. Two colonies of bacillus subtilis. Other tubes sterile.	In hospital fifteen days. Cured.
9. Carroll.....	97, m.; 25; porter..	Swelling of metacarpo-phalangeal joints of hands, also about tarsal joints of feet. Temp., 101° F., gradually falling to normal. Pulse and respiration normal.	Vein puncture. May 20, '97.	No growth.....	In hospital eight days. Cured. No complications.
10. Mikas.....	196, m.; 27; carpenter.	Pain in knees and wrists, and over front of chest. Dyspnea, swelling of feet and legs. Pericardial friction sounds. Mitral systolic murmur. Temp., 102-3.5° F.; pulse, 95; resp., 30-40.	Vein puncture. June 10, '97.	No growth.....	In hospital forty-five days. Cured. Complications; pericarditis and double pleurisy with effusion. Temp. normal after seventeen days. Hemoglobin increased from fifty-five to seventy-seven per cent.
11. Miller.....	207, m.; 26; pedler.	Pain in right leg and ankle, the latter swollen. Double murmur over mitral area. Temp., 101.5-3° F., gradually falling. Urine, negative.	June 23, '97....	In one tube one colony of staphylococcus pyogenes albus. The others sterile.	In hospital twenty-three days. Cured. Chronic endocarditis.
12. McDonald..	222, f.; 37; domestic.	Pain and swelling of right knee. Temp., 100-3° F. No complications.	Vein puncture. June 15, '97.	One tube shows a single colony of yellow sarcinae. Others sterile.	In hospital twenty-two days. Cured.
13. Hasselbach.	256, f.; 20; housewife.	Pain and stiffness in many joints. Dyspnea. Double mitral murmur. Chorea movements in limbs, more marked on right side. Temp. not above 101° F.; irregular.	Vein puncture. June 19, '97. Vein puncture. June 26, '97.	No growth..... No growth.....	In hospital fifteen days. Cured.
14. McGourty...	267, m.; 24; laborer.	Right shoulder and both knees swollen, tender, painful and contain fluid. Both ankles and small joints of both feet and right hand swollen and painful.	Vein puncture. June 29, '97.	No growth.....	Cured after twelve days.
15. Lyons.....	257, m.; 19; telegrapher.	Heart normal. Temp., 104.5° F.; falling to normal on fourth day. Urine, normal. Right wrist, knee, and both ankles swollen, painful, and tender. Faint mitral murmur. Temp., 102.5° F.; pulse, 94-100.	Vein puncture. June 26, '97.	No growth... ..	In hospital fifteen days. Cured. Temp. normal on fifth day.

16. Schlier . . .	272, m.; 33; laborer.	Right knee, right foot, and joints of both hands affected in order. Knee contains fluid. Heart, normal. Urine, normal. Temp., 102-103° F. for two weeks; pulse, 90-100; resp., 24.	Vein puncture. July 2, '97.	No growth.	In hospital fifty days. Cured. Severe conjunctivitis of both eyes. No other complications.
17. Collins. . . .	Bellevue Hospital, m.; 32; carpenter.	Temp., 102.4° F. Began to have pain in right hip, June 22, 1897.	Vein puncture. June 29, '97.	No growth.	In hospital fourteen days. Cured.
18. Fagan. . . .	436, m.; 19; mason.	Both knees swollen, painful, and contain fluid. Left wrist also swollen, red, and painful. Temp. irregular, 99-102° F.; at times, 103° F.; pulse, 108; resp., 20.	Vein puncture. Aug. 30, '97.	No growth.	Cured after ninety-two days. Later, the disease recurred with purulent effusion into the knee-joints. Treated by incision and drainage, patient rapidly recovered with good movable joints.
19. Spraul. . . .	Second examination. 263, m.; 23; baker.	.....	Nov. 14, '97. . . .	No growth.	.....
20. Balta. . . .	Bellevue Hospital, m.; 22; driver.	Pain, swelling, and tenderness in right knee. Some fluid in joint. Temp., 101-103-104° F.	Vein puncture. June 29, '97.	No growth.	.....
21. Welden. . .	F.; 48; cook. . . .	Pain in right foot, June 2. Admitted to hospital, June 13. Temp. has ranged from 100-102° F.	Vein puncture. June 29, '97.	No growth.	.....
22. Feeny. . . .	262, f.; 34; housewife.	Compulent; anæmic; general weakness and prostration. Chronic rheumatism affecting hands and feet. Swelling and stiffness of joints. Great pain; moderate fever, irregular type. Double mitral regurgitation. Double mitral murmur. Pain and swelling of feet. Miscarriage at eighth week. Temp. irregular but moderate, 101-5° F.	Vein puncture. July 5, '97.	No growth.	.....
23. Grenet. . . .	846, f.; 14; school.	Pain in knees, wrists, and elbows. Redness, but no swelling of joints. Double mitral murmur. Temp., 103° F., reaching normal in ten days.	Vein puncture. Nov. 28, '97.	No growth.	In hospital twenty-two days.
24. H. H. . . .	M.; 13; none. . . .	Acute articular rheumatism. Pericarditis. Double pneumonia. Temp., 102-4° F.; pulse very rapid and irregular. Chorea of most violent type, with maniacal delirium.	Vein puncture. May 24, '97.	No growth.	Died in typhoid state. No autopsy.
25. De Bates. . .	943, f.; 35; housewife.	Fever for a month. Both wrists and left knee swollen, painful, and tender for two weeks. Delirium. Temp., 101-2.8° F.	Vein puncture. Dec. 30, '97.	No growth.	Still in hospital. Cultures from knee-joint negative.
26. Woop. . . .	835, m.; 38; pedler.	Markedly alcoholic. Tremulous and delirious. Feet swollen. Systolic murmur at apex. Slight pericardial sound. Inflamed ulcer of leg. Temp., 104° F.; pulse, 72; resp., 24.	Vein puncture. Nov. 30, '97.	No growth.	Still in hospital.

TYPHOID FEVER.

The literature of typhoid fever for the past few years contains a large number of records of attempts to demonstrate the bacillus in the blood of persons suffering from the disease.

Gaffky,⁸ in 1884, soon after the discovery of the bacillus typhi, tested the blood of a number of cases, but did not succeed in cultivating the micro-organism from it.

R. Stern⁹ examined with much care the blood of six cases of typhoid fever. In some he disinfected the bend of the elbow as far as was possible and drew from a vein a considerable quantity of blood by means of a sterilized hypodermic syringe. In others he examined blood from a rose spot. In three of the six cases he obtained a growth of the typhoid bacillus, two being in blood from rose spots, one from the vein. In each of the successful cases he obtained but few colonies.

Banti,¹⁰ in one of two cases examined, was able to obtain the bacilli.

Neuhaus¹¹ claims that the bacilli of the disease accumulate especially in the rose spots, and says that one is much more apt to obtain a growth by taking blood from this situation. He examined fifteen cases in this way and was able to cultivate the typhoid bacillus in nine.

Fränkel and Simmonds¹² found the bacillus in only one case out of six examined.

Meisels¹ examined nine cases by taking a drop of blood from the finger-tip, and claims to have discovered the bacillus in them all, but his method was so inaccurate that his results can hardly be regarded as deserving of confidence.

Almqvist,¹³ in an investigation carried out in the same faulty way, has obtained the same constant positive result.

Seitz¹⁴ was unable to obtain the bacilli from the blood of any of his cases.

Lucatello¹⁵ similarly always met with negative results.

Rutimeyer¹⁶ sowed blood taken from rose spots in six cases, and in one only found a growth of the typhoid bacillus.

Widal and Chantemesse¹⁷ obtained a growth from blood from the rose spots.

Stagnitta² examined the blood in fourteen cases, both by culture and by the microscope, and always with negative result.

Wiltshour,¹⁸ in thirty-five cases, was able to discover the typhoid bacillus only once in the blood.

Pasquale¹⁹ had a positive result in one case.

Thiemich²⁰ made a careful study of severe cases, obtaining specimens of blood both from the rose spots and from the veins, always using thorough disinfection. Three times he obtained a growth of the bacillus typhi from rose spots, once only from a vein.

Kühnau,³ in his very large and carefully conducted series of blood examinations, numbers forty-one cases of typhoid fever. In nine of these he succeeded in cultivating a growth of the typhoid bacilli, but in each case the number of colonies was small.

Our cases of typhoid fever examined number thirty-eight.

In three of them the bacillus typhi was obtained by culture from the blood. In two of the cases only one colony developed in one tube; in the other case there was one colony in every tube. This last case was one of great severity, ending fatally. In this patient, the finding of the bacteria in the blood was an important aid in diagnosis, as up to this time the case was an obscure one, and so closely resembled septic disease that, without the aid of the blood-culture, a positive differential diagnosis would have been impossible.

We have concluded as follows:

1. That the bacillus typhi can be demonstrated in the blood in a considerable number of cases of typhoid fever, the exact proportion of these cases being as yet undetermined.

2. The finding of the bacillus in the blood does not give any positive indication of the severity or probable termination of the case.

3. That in a few cases it may be of value in diagnosis.

4. We have no knowledge of the period at which, or the circumstances under which, the bacilli are most apt to be found.

TYPHOID FEVER.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
27. Ahrendsdorf..	682, m.; 32; cigar-maker.	Spleen palpable. Eruption, few spots. Temp., 101-4° F.; pulse, 100-105; resp., 28-34.	Vein puncture. Oct. 7, '97.	No growth	In hospital forty-nine days. Cured. Widal reaction on tenth day. Relapse.
28. Steinbach...	579, f.; 24; housewife.	Chill, fever, sweating, headache, vomiting. Slight hemorrhage beginning of second week. Spleen palpable. Temp., 104-5° F.; pulse, 120; resp., 30.	Vein puncture. Sept. 9, '97.	No growth	In hospital thirty-nine days. Cured. Widal reaction on twenty-second day. Complication, furunculosis.
29. Reilly.....	717, f.; 19; domestic.	Marked eruption. Spleen palpable. Some diarrhea. Temp., 102-4° F.; pulse, 100-110; resp., 24.	Vein puncture. Oct. 18, '97.	No growth	In hospital forty-four days. Cured. Widal reaction on twelfth day. Sub-acute colitis.
30. Rothenhaus let.	454, m.; 30; fireman.	Delirium, tongue dry and brown. Marked tympanites. Repeated intestinal hemorrhages. Spleen not felt. Eruption, few spots. Temp., 103-5° F.; pulse, 100-20; resp., 24.	Vein puncture. Aug. 4, '97.	No growth.....	Died at end of fourth week of exhaustion from hemorrhages and peritonitis. No autopsy. Widal reaction strong. In hospital ten days.
31. Rosenberg ..	443, f.; 21; domestic.	Typhoid eruption. Enlarged spleen. Constipation. Temp., 104-5° F.; pulse, 120-30; resp., 20-18.	Vein puncture. Aug. 14, '97.	No growth	In hospital forty-nine days. Cured. Relapse.
32. Rothschild ..	535, f.; 23; domestic.	Chilly sensations. Spleen not palpable. Temp., 101-4° F. for two days, then 100-1° F.	Vein puncture. Aug. 25, '97.	In one tube one colony of staphylococcus pyogenes albus. Other tube sterile.	Probably not typhoid fever. Reacted moderately to tuberculin. No localized tuberculosis discovered.
33. Neilson.....	Second examination. Bellevue Hospital, f.; 22; domestic.	Specimen taken on twenty-sixth day of disease.	Aug. 30, '97 ...	No growth	In hospital fifty days. Cured.
34. Moores	722, m.; 36; artist.	Malaise, vomiting. Spleen palpable. Eruption, few spots. Temp., 101-2.5° F.; pulse, 88; resp., 22.	Vein puncture. June 29, '97.	No growth	In hospital fifty one days. Cured.
35. Lindberg ..	379, m.; 25; architect.	Typhoid symptoms not marked. Temp., 100-1.5° F.; pulse, 80-96; resp., normal. Headache, malaise. Spleen not palpable. Few spots.	Vein puncture. Oct. 23, '97.	No growth	In hospital thirty-eight days. Cured. No complications.
36. Lang	449, m.; 17; plumber.	Headache, malaise. No diarrhea. Spleen at first palpable. Right kidney much swollen and tender. Temp. irregular, 102.5-3.5° F.; pulse, 80-90; resp., 24. Urine, 1016; albumin, considerable. Some pus; granular, hyaline, and blood-casts; many blood-cells.	Vein puncture. July 24, '97.	No growth	In hospital thirty-two days. Cured. A mild continued fever. Probably not typhoid fever. No complications.
37. Kiplan.....	505, m.; 24; printer.	Temp., 103-4° F.; pulse, 80; resp., 20. Pain in abdomen. Spleen not palpable. No eruption.	Vein puncture. Aug. 9, '97.	No growth	Most of the symptoms were referable to the right kidney. Widal reaction strong. Urine contained an abundance of typhoid bacilli. In hospital forty-one days. Cured.
38. King	160, m.; 23; conductor.	Characteristic symptoms. Spleen palpable. Eruption on abdomen. No diarrhea. Temp., 101-3° F.; pulse, 96; resp., 24.	Vein puncture. June 14, '97.	No growth	Had typhoid fever in Mt. Sinai Hospital, of four weeks' duration. Was apparently well for four weeks. Present illness gave every indication of being a relapse. Widal reaction good. Discharged, cured, after twenty-six days.
					In hospital sixty-five days. Cured. Temp., afterward, 103.5° F. No complications.

39. Lavine	557, f.; 27; housewife.	Diarrhoea. Tongue dry, red, and cracked; delirium. Spleen percusses large. Hypostatic congestion of lungs. Urine, 1020; considerable albumin; few leucocytes; no casts. Temp., 104-5° F.; pulse, 130-40; resp., 25-36. Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	One colony of typhoid bacilli in each tube.	Died after ten days. Widal reaction good. No autopsy.
40. Kuhlman	595, m.; 23; driver.	Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	No growth	In hospital thirty-one days. Cured. Some furuncles on back.
41. Karsch	681, m.; 12; school.	Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	No growth	In hospital thirty-six days. Cured.
42. Karsten	354, m.; 21; salesman.	Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	No growth	In hospital thirty-four days. Cured. No complications.
43. Dwyer	760, f.; 32; domestic.	Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	No growth	In hospital forty days. Cured.
44. Cresswell	795, m.; 27; waiter.	Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	No growth	Sixty-six days in hospital. Relapse. No complications. Cured.
45. Barta	Bellevue Hospital, f.; 17; domestic.	Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	No growth	In hospital forty-nine days. Cured.
46. Brophy	374, m.; 24; station-master.	Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	No growth	In hospital thirty-four days. Cured. No complications.
47. Brennan	811, m.; 39; police.	Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	No growth	Still in hospital. Relapse. Developed an axillary abscess, in which only cocci were found.
48. Tighe	217, m.; 25; plumber.	Headache, epistaxis. Some diarrhoea. Spleen not palpable. No eruption. Symptoms not typical. Temp., 102-3° F.; pulse, 80-88; resp., 20. Headache, delirium. Spleen palpable. Eruption fairly abundant. Temp., 102-2.5° F.; pulse, 80-90; resp., 20. Urine, small amount of albumin. Diarrhoea, malaise, prostration. Spleen percusses large; not felt. Few typhoid spots. Temp., 103-4° F.; pulse, 90; resp., 20. Urine, negative. Headache, prostration, vomiting. Spleen palpable. Eruption slight. Temp., 102-3.5° F.; pulse, 90; resp., 24. Headache, epistaxis, diarrhoea. Spleen palpable. Eruption typical. Delirium. Temp., 104° F., pretty regular; pulse, 88; resp., 24. Specimen taken on twenty-sixth day of disease. Widal test, good reaction on sixteenth day. Temp., 102-4° F., till June 24; now, 100° F. Headache, malaise, prostration, diarrhoea. Enlarged spleen. Eruption. Temp., 103-4° F.; pulse, 88; resp., 20-24. Urine, negative. Typical eruption. Spleen palpable. Good Widal reaction. Temp., 102-3.5° F.	In one tube one yellow colony of sarcinae. Other tubes sterile. One tube contaminated with bacillus subtilis. Others sterile.	In hospital thirty days. Cured. No complications.
49. Teubert	466, m.; 39; laborer.	Headache, malaise, apathy. Spleen palpable. Slight eruption. Some tympany, and abdominal pain. Temp., 102-4° F.; pulse, 100; resp., 24. Diarrhoea. Pain in back and limbs. Epistaxis. Spleen palpable. Slight eruption. Temp., 103-4° F.; pulse, 90; resp., 24. Typhoid facies. Spleen percusses large. Eruption on abdomen. Temp., 102-3.5° F.; pulse, 95; resp., 22. Urine, negative. Marked eruption. Spleen palpable, rather irregular.	In one tube one colony of typhoid bacilli. The other tubes are sterile.	In hospital fifty-one days. Cured. No complications.
50. Roberts	801, m.; 18; clerk.	Headache, malaise, apathy. Spleen palpable. Slight eruption. Some tympany, and abdominal pain. Temp., 102-4° F.; pulse, 100; resp., 24. Diarrhoea. Pain in back and limbs. Epistaxis. Spleen palpable. Slight eruption. Temp., 103-4° F.; pulse, 90; resp., 24. Typhoid facies. Spleen percusses large. Eruption on abdomen. Temp., 102-3.5° F.; pulse, 95; resp., 22. Urine, negative. Marked eruption. Spleen palpable, rather irregular.	One colony of typhoid bacilli in one tube. The other tubes are sterile.	In hospital forty-seven days. Cured. No complications.
51. Henry	460, m.; 8; school.	Headache, malaise, apathy. Spleen palpable. Slight eruption. Some tympany, and abdominal pain. Temp., 102-4° F.; pulse, 100; resp., 24. Diarrhoea. Pain in back and limbs. Epistaxis. Spleen palpable. Slight eruption. Temp., 103-4° F.; pulse, 90; resp., 24. Typhoid facies. Spleen percusses large. Eruption on abdomen. Temp., 102-3.5° F.; pulse, 95; resp., 22. Urine, negative. Marked eruption. Spleen palpable, rather irregular.	No growth	In hospital thirty-one days. Cured. There is a good Widal reaction.
52. Harris	668, f.; 29; housewife.	Headache, malaise, apathy. Spleen palpable. Slight eruption. Some tympany, and abdominal pain. Temp., 102-4° F.; pulse, 100; resp., 24. Diarrhoea. Pain in back and limbs. Epistaxis. Spleen palpable. Slight eruption. Temp., 103-4° F.; pulse, 90; resp., 24. Typhoid facies. Spleen percusses large. Eruption on abdomen. Temp., 102-3.5° F.; pulse, 95; resp., 22. Urine, negative. Marked eruption. Spleen palpable, rather irregular.	No growth	In hospital thirty-one days. Cured. After regular course of typhoid fever at home, was perfectly well for one week, then had a relapse, for which she was brought to the hospital.

TYPHOID FEVER (Continued).

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
53. Gillespie....	566, m.; 35; clerk.	Nausea, vomiting. Spleen palpable. No eruption. Temp., 102-3.5° F.; pulse, 112; resp., 24. Urine, negative.	Vein puncture Sept. 26, '97.	Two tubes contaminated. Sarcinae, very large cocci. Other tubes sterile.	In hospital sixty three days. Cured. Widal reaction not obtained until third day of relapse.
54. Gillespie....	699, m.; 22; packer.	Headache, malaise, prostration. Spleen not palpable. Eruption, few spots. Temp., 102-3° F.; pulse, 80-90; resp., 24. Urine, negative.	Vein puncture, Oct. 14, '97.	No growth	In hospital forty-three days. Cured.
55. Gross.....	419, m.; 24; beer-bottler.	Diarrhea, headache, chilly sensations, apathy. Spleen palpable. Eruption marked. Temp., 103-4° F.; pulse, 90; resp., 24.	Vein puncture, July 24, '97.	No growth	Profuse hemorrhage from nose. Also hemorrhage from left eye and ear. Blood in urine and stools. Numerous purpuric spots on skin. Temp., 104-5° F.; pulse, 130; resp., 30. Marked Widal reaction. Discharged, cured, after sixty-five days.
56. Fürst.....	Second examination. 378, f.; 29; housewife.	Complicated with purpura hemorrhagica. Diarrhea. Enlarged spleen. Few spots on abdomen. Temp., 102-3.8° F.; pulse, 90-100; resp., 20-24.	July 29, '97 Vein puncture, July 16, '97.	No growth. No growth	In hospital thirty eight days. Cured. Patient had a miscarriage three weeks before beginning of disease. Widal reaction good.
57. Donohue....	283, m.; 28; laborer.	Headache, malaise. Spleen palpable. Eruption, few spots. Temp., 103.5-4.5° F.; pulse, 90; resp., 24.	Vein puncture, July 20, '97.	No growth	In hospital forty-eight days. Cured.
58. Doyle.....	67, m.; 24; printer.	Moderate diarrhea. Eruption, few spots. Spleen not palpable. Temp., 102-3.5° F.; pulse, 88-100; resp., 24. Urine, negative.	Vein puncture, June 14, '97.	No growth	In hospital sixty-eight days. Cured. Relapse. Femoral phlebitis. Good Widal reaction.
59. Curtis	Bellevue Hospital, m.; 26.	Twenty-sixth day of disease. Temp., 101.8° F., at time of examination.	Vein puncture, Dec. 17, '97.	No growth	Complication lobar pneumonia. Consolidation of the entire upper right lobe. Resolution on the sixth day.
60. Miller	861, f.; 33; housewife.	Twelfth day of disease. Spleen palpable. Eruption present. Delirium. Intestinal hemorrhage. Temp., 104-6° F.	Vein puncture, Dec. 4, '97.	In one tube one orange-colored colony of staphylococcus pyogenes aureus. Probably a contamination. The other tubes are sterile.	Still in hospital.
61. Butzel	833, m.; 38; laborer.	Twentieth day of fever. Spleen palpable. Good Widal reaction. Typical eruption. Temp., 103-4° F.	Vein puncture, Nov. 28, '97.	No growth	Still in hospital. Has had a relapse. Still has at times an irregular fever.
62. Bradley.....	785, m.; 39; ticket-agent.	Chilly sensations, headache, constipation. Spleen large. Eruption typical. Temp., 102-3° F.; pulse, 100.	Vein puncture, Nov. 14, '97.	No growth	No complications. In hospital forty-six days. Cured.
63. Berger.....	868, m.; 28; clerk..	Chill, vomiting, severe headache, backache, and diarrhea. Spleen large. Some eruption. Temp., 102-4° F.	Vein puncture, Dec. 11, '97.	No growth	Still in hospital.
64. Johnson ...	871, m.....	Backache, anorexia, malaise. Typical eruption. Spleen palpable. Temp., 102-4° F.	Vein puncture, Dec. 10, '97.	No growth	Still in hospital.

TUBERCULOSIS.

In the present investigation the chief interest in connection with tuberculosis was the search for the pyogenic micro-organisms in the blood of cases of mixed tubercular and septic infection. It was not to be expected that tubercle bacilli would grow in the tubes, even had they been present in the blood when drawn, and no special effort was made to cultivate them.

Kühnau³ examined the blood of 12 cases of tuberculosis with severe mixed infection. In 8 of them the tubes and plates remained sterile, while in the other 4 there were contaminations from the air; in none did any pyogenic bacteria develop. In each of the 12 cases he inoculated freshly drawn blood into guinea-pigs, with only one positive result. This animal died of tuberculosis after the lapse of three months.

We have examined the blood of 16 cases of tuberculosis clinically of varying degrees of intensity. Some were apparently cases of mixed infection, others tuberculosis alone. In 14 cases the tubes remained sterile; the other 2 showed accidental contamination.

In conclusion, it seems probable that in tuberculosis even with added septic infection as it is usually met with, the examination of the blood for bacteria is of little or no value; this is perhaps because in these cases the septic element of the disease is almost invariably strictly localized. General pyæmic infection with septic metastases is rarely or never met with as a result of pulmonary tuberculosis. Thus we see that as far as blood-cultures indicate, the secondary septic infection of pulmonary tuberculosis, even when its clinical manifestations indicate very great intensity, nevertheless corresponds in this particular to a purely local septic process.

PLEURISY.

Our list of cases comprises 5 of simple pleurisy with effusion, 3 of empyema. In none of them did we succeed in cultivating bacteria from the blood, nor have we found any record of its having been accomplished by other observers.

This result is what we would expect from theoretical considerations.

TUBERCULOSIS.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
65. Clark	620, m.; 35; laborer.	Slight dullness and subcrepitant râles at left apex. Tubercle bacilli found in sputum. Temp., 101-2° F.; pulse, 90-110; resp., 30.	Vein puncture. Oct. 1, '97.	No growth.....	In hospital fifty-eight days. Not improved.
66. Daley.....	285, m.; 23; floor-polisher.	Frequent hæmoptyses. Dullness over right apex with broncho-vesicular voice and breathing. Temp., 101-3.5° F. Urine, negative.	Vein puncture. July 5, '97.	One tube shows an abundant growth of bacillus subtilis. Other tubes sterile.	In hospital twenty-two days. Improved.
67. McDonald ..	F.; 24; laundress..	Irregular temperature of last stages of phthisis.	Vein puncture. May 12, '97.	No growth.....	In hospital sixty-four days. Died.
68. Miller.....	6-6, f.; 12; school..	Signs of cavity in left apex. Profuse, foul-smelling expectoration. Temp. irregular, 104° F.; pulse 120; resp., 40.	Vein puncture. Oct. 7, '97.	No growth	In hospital nine days. Not improved. Gangrene of lung.
69. Callahan ...	220, f.; 24; housewife.	Subacute phthisis. Right knee swollen and painful. Cough. Few râles over both lungs, but more at right apex. Temp., 100-1° F. Urine, negative.	Vein puncture. June 14, '97.	No growth.....	In hospital eighteen days. Improved.
70. Metzger.....	103, m.; 44; blacksmith.	Some dullness over right chest. Many râles. Temp., 104-5° F. in evening; normal or subnormal in morning. Tubercle bacilli found.	Vein puncture. June 14, '97.	No growth.....	In hospital forty-six days. Improved.
71. Leslie	630, m.; 33; bartender.	Cough. Morning vomiting. Over right lower lobe signs of pleurisy. Temp. pretty regular, 101-2° F.; pulse, 80; resp., 22. Reacts to tuberculin.	Vein puncture. Sept. 30, '97.	No growth.....	In hospital sixty-three days. Improved. Slight temperature persists, and signs of pleurisy.
72. Heislert.....	710, m.; 38; marble cutter.	Dullness over right upper lobe. Crepitant and subcrepitant râles over both lungs. Temp., 102-4° F.; irregular; pulse, 90-100; resp., 36.	Vein puncture. Oct. 14, '97.	No growth.....	In hospital fifty-two days. Improved.
73. Diamond....	591, m.; 39; plumber.	Abscess of lung. Cough, dyspnoea, emaciation. Dullness with diminished voice and breathing at left apex. Temp. very irregular, 99-104-105-106° F.; pulse, 28; resp., 36.	Vein puncture. Sept. 14, '97.	No growth.....	In hospital twenty-seven days. Died.
74. Cabana	13, m.; 24; lather..	Pain in epigastrium and scapular spaces. Subcrepitant and sonorous râles over upper part of left lung. Temp. generally 100-1° F.; occasionally 105° F.	Vein puncture. May 13, '97.	No growth.....	In hospital seventy days. Improved. Suddenly gave signs of pneumothorax of left side, which gradually disappeared. No tubercle bacilli were found.
75. Cherubic....	538, f.; 20; domestic.	Cough, muco-purulent expectoration. One hæmoptysis. Dullness over right apex. Signs of fluid in left pleura. Temp., 103-4° F.; pulse, 104; resp., 30-40.	Vein puncture. Aug. 30, '97.	Contaminated	In hospital ninety-four days. Improved. Pneumothorax. Pleurisy with effusion. Abscess of lung.

76. Cahlmann....	618, m.; 50; var- nisher.	Cough, profuse expectoration. Emaci- ation. Anemia. Mitral regurgitation. Dulness and moist râles over right apex. Temp., 101-4° F.; irregular. No tubercle bacilli found.	Vein puncture. Sept. 20, '97.	No growth.....	In hospital thirteen days. Died. Broncho-pneumonia.
77. Behrens.....	264, f.; 36; house- wife.	Tuberculosis of kidney. Chills at irreg- ular intervals. Fever and sweating. Spleen palpable. Right kidney en- larged and tender. Considerable pain in right side. Temp., 100-2° F., but irregular; pulse, 80; resp., 24. Urine contains a small amount of pus.	Vein puncture. July 3, '97.	No growth.	In hospital fifty-one days. Improved.
78. R. W.	M.; 20; none.....	Acute pulmonary tuberculosis. Mixed infection. Septic. Pyopneumothorax. Temp., 101-3° F.; pulse, 140.	Vein puncture. Oct. 6, '97.	No growth.	Disease progressive. Not improving.
79. Walsh	817, m.; 40; laborer.	Indefinite signs over lungs. Tubercu- losis mostly confined to bones. Good tuberculin reaction. Temp. irregular, up to 103° F.	Vein puncture. Nov. 23, '97.	No growth... ..	Still in hospital.
80. Faulkner....	838, m.; 29; plumb- er.	Temp. irregular, 103° F. in evening; 100-1° F. in morning. Tubercle bacilli found in sputum.	Nov. 23, '97.	No growth.....	Still in hospital.

PLEURISY WITH EFFUSION.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
81. Shanahan ..	157, m.; 40; laborer.	Large amount of fluid in right pleural cavity. Temp., 102-3° F.; pulse, 75-80; resp., 24-30. Only other symptom, moderate dyspnea on exertion.	Vein puncture. June 7, '97.	No growth	Fluid aspirated, but again accumulates. Discharged, improved, after twenty-eight days.
82. Carter	434, m.; 33; porter.	Signs of fluid in right chest up to angle of scapula. Twenty-three ounces of clear serum aspirated. Chilly sensations, vomiting, and prostration. No cough. No pain. Temp., 102-3° F.; pulse, 100; resp., 24-30.	Vein puncture. Aug. 4, '97.	No growth	In hospital twenty-six days. Cured. No complications.
83. Keenan.....	177, m.; 36; bartender.	Dyspnea, with pain in chest. Respiration, diaphragmatic. Pericardial friction sounds. Fluid in both pleural cavities. Temp. pretty regular, 101.5° F., twice reaching 103° F. Urine: 1025; albumin, twenty-five per cent.; hyaline and granular casts.	Vein puncture. June 7, '97.	No growth	In hospital forty-five days. Cured. Double pleurisy. Pericarditis. Lobar pneumonia. Albumin and casts disappeared from urine.
84. Kelly	Second examination. 26, m.; 21; clerk...	Pain in joints all over the body. No swelling. Vomiting. Palpitation of heart. Loud systolic murmur at apex. Double pericardial friction sound. Fluid in both pleural cavities. Temp., 103-5.5° F. for two weeks; pulse, 116-28; resp., 36. Urine contains a trace of albumin and a few granular casts.	July 5, '97..... Vein puncture. May 12, '97.	No growth. No growth	In hospital fifty-three days. Cured. Pleural cavities free from fluid. Pericardial sounds have disappeared.
85. Howe	786, f.; 28; none...	Cough, some expectoration. Pain in left side. Chill. Fluid in left pleural cavity from second intercostal space to base. Temp., 102-4° F.; pulse, 118; resp., 30. No tubercle bacilli found.	Vein puncture. Nov. 8, '97.	No growth	Large quantity of clear fluid removed by aspiration. Some broncho-pneumonia. In hospital thirty-two days. Cured.

EMPHYEMA.

86. Mackay....	8, m.; 31; coachman.	Cough. Pain in left side. Left pleural cavity contains large amount of pus. Temp. irregular, 100-99° F.	Vein puncture. May 4, '97.	No growth	Resection of rib and drainage, followed by improvement. In hospital sixty-five days. Cured.
87. Lawson.....	304, m.; 44; carpenter.	Dyspnea. Cough. Pain in right side of chest. Percussion note flat on right side. Temp., 99.5-103.9° F. Emaciation. Night sweats. Pus obtained from right chest with exploring needle.	Vein puncture. July 12, '97.	No growth	In hospital fourteen days. Not improved.
88. Lawson.....	m.; 24; student....	Emphyema, following pneumonia of left lower lobe. Fever, moderate and very irregular. Several times reached 104° F. Heart, rapid and feeble.	Vein puncture. June 15, '97.	No growth	In hospital ninety-nine days. Cured. Resection of rib.

PNEUMONIA.

Under this heading are included only cases of acute lobar pneumonia. The distribution of the micrococcus lanceolatus in the body, in cases of pneumonia, has been the subject of a number of inquiries on the part of the earliest students of this micro-organism.

Orthenberger,²¹ in Weiggert's laboratory, in 1888, examined the tissues of six fatal cases, with a view of determining whether the bacteria existed in the various organs. He found them in the liver, spleen, and kidneys, and generally within the lumen of the blood-vessels. He determined, therefore, that in all of these cases they had passed into the blood-current, and had in this way been carried throughout the body. He suggests that the further study of the relation of the organisms to the blood must be carried out by means of cultures from the living blood.

Weichselbaum,²² at about the same time, found the diplococci present in the blood of pneumonia cases after death.

Queissner²³ examined the lungs of ten children that had died of pneumonia and found the pneumococci in all of them situated in the lumen of the vessels.

Faulhaber²⁴ studied the question whether in the infectious disease the bacteria causing the various morbid processes exist in the kidneys. In a number of fatal cases of pneumonia, he demonstrated the presence of the micrococcus lanceolatus in this situation. Kühnau³ examined the blood of 9 cases of severe uncomplicated pneumonia, 3 of them being fatal cases. In only 1 did he succeed in finding the diplococcus. He concludes that in this disease the bacteria in a few cases exist in the living state in the blood, and that probably these are generally severe examples of the disease.

In our investigation we have examined the blood in 12 cases of pneumonia. Two of these were fatal, the remaining 10 recovered. In none of them did we succeed in obtaining a growth of the diplococcus in the tubes inoculated with the blood.

PNEUMONIA, ACUTE LOBAR.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
89. Joinville ...	90, m.; 35; laborer.	Cough, bloody expectoration. Consolidation of part of right lower lobe. Temp., 105-6° F.; pulse, 104-20; resp., 20-25. Delirious on sixth day. Consolidation of right lower lobe. Temp., 104° F.; pulse, 112; resp., 30-40. Urine contains a small amount of albumin.	Vein puncture, May 18, '97.	No growth.....	In hospital twenty-two days. Cured.
90. Wichert....	654, m.; 50; painter.	Consolidation of right lower lobe. Temp., 104° F.; pulse, 112; resp., 30-40. Urine contains a small amount of albumin.	Vein puncture, Sept. 30, '97.	No growth.....	In hospital five days. Died. Autopsy confirmed the diagnosis.
91. Loughlin...	M.; 55; dockmaster.	Broncho-pneumonia. Pleurisy with effusion. Cough; pain in chest. Signs of pleurisy on left side. Fluid reaching to angle of scapula. Temp., 102-3° F.; pulse, 80-90; resp., 32.	Vein puncture, June 19, '97.	No growth.....	In hospital twenty-two days. Cured. Bronchial voice and breathing in places over left lung after fluid subsided.
92. Daley.....	847, f.; 50; housewife.	Chill, fever, vomiting. Consolidation of right lower lobe. Temp., 104° F.; pulse, 100-8; resp., 30-40.	Vein puncture, Nov. 28, '97.	No growth.....	In hospital twenty-two days. Cured.
93. Shea.....	F.; 55; housewife..	Broncho-pneumonia. Temp., 102-3° F. Marked prostration.	Vein puncture, Oct. 18, '97.	No growth.....	Still in hospital in very feeble condition, with incontinence of urine and faeces.
94. Brauer.....	Bellevue Hospital, m.; 43.	Consolidation of right upper lobe. Temp., 102° F. on fourth day. Resolved on eighth day. Now temp., 99.6° F.	Vein puncture, Dec. 17, '97.	No growth.	
95. Hedwig ...	834, m.; 33; clerk.	Chill, headache, pain in neck and shoulders. Consolidation of large part of both lower lobes. Temp., 105° F.; pulse, 105-90; resp., 30-36.	Vein puncture, Nov. 23, '97.	No growth.....	Plasmodia malariae found in the blood. Temp. high for five days; dropped to normal on sixth day. In hospital twenty-seven days. Cured.
96. Clark.....	Bellevue Hospital, m.; 27.	Markedly alcoholic. Consolidation of lower lobe of right lung. Specimen taken on eighth day of disease. Temp., 102.5° F.; has been 106° F.; pulse, 120; resp., 32.	Vein puncture, Jan. 5, '98.	No growth.....	Still in hospital.
97. Coirn.....	Bellevue Hospital, m.; 27; laborer.	Consolidation of right upper lobe. Specimen taken on sixth day of disease. Temp., 104.6° F.; pulse, 96; resp., 32.	Vein puncture, Jan. 5, '98.	No growth.....	Still in hospital.
98. Fennelly ...	Bellevue Hospital, m.; 22.	Consolidation of left lower lobe. Marked general bronchitis. Specimen taken on fifth day of disease. Temp., 104° F.; pulse, 120; resp., 26. Leucocytosis—10,000 cells per cubic mm.	Vein puncture, Jan. 5, '98.	No growth.....	Still in hospital.
99. Clark.....	F.; 67; housewife.	Sick fifteen days. Consolidation of left lower lobe. Temp., 104° F.	Vein puncture, Jan. 6, '98.	No growth.....	Died on fourth day. Autopsy showed gray hepatization of right upper lobe and red hepatization of part of the left upper lobe.
100. Donohue...	856, m.; 38; laborer.	Consolidation of right upper lobe, also signs of consolidation over left upper lobe.	Vein puncture, Nov. 30, '96.	No growth.....	

MENINGITIS.

Only 4 undoubted cases of this disease came under our observation, in which culture experiments were carried out. In 3 of these the tubes remained sterile; in the fourth, a tolerably large number of colonies of the micrococcus lanceolatus developed. The case terminated fatally, but, unfortunately, permission to hold an autopsy could not be obtained, and consequently opportunity was lacking to verify the results of the blood-culture by cultures from the meninges after death. Acute meningitis is recognized to be a fairly frequent complication of endocarditis pneumonica, that is of that form of malignant endocarditis which is caused by the micrococcus lanceolatus. Also, our own investigations indicate that in a large proportion of cases of this disease, the bacterium in question can be cultivated from the blood *intra vitam*, and hence it seems probable that this procedure, blood-cultivation, may be of considerable value as an aid to the exact diagnosis during life of the kind of meningitis that may be present in any given case.

MALIGNANT ENDOCARDITIS.

A fairly large number of cases of malignant endocarditis have been recorded in which cultures from the blood taken during life have demonstrated the presence of various forms of pathogenic bacteria. Moreover, this result is quite in accordance with what would naturally be expected from a study of the pathological conditions which constitute the disease. The existence in the heart-valves of vegetations, in many cases of exuberant and rapid growth, and often with ulcerating surfaces, furnishes the best possible opportunity for throwing into the blood-current a large number of bacteria in a state of vigorous development. Moreover, the complicating lesions of the disease, the petechiæ in the skin, and the embolic accidents that happen in the various organs, all indicate the existence and the wide distribution in the blood of the *materies morbi*. So that it is quite to be expected that the blood, if carefully examined would, at least in a fair proportion of the cases, show the existence of the bacteria which are the cause of the disease.

Grawitz²⁵ examined the blood of a case of malignant endocarditis

MENTINGITIS.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
101. Conlin	114, m.; 30; book-keeper.	Headache, rigidity of muscles of neck, restlessness, delirium. Temp., 102° F.; pulse regular; pulse, 72; resp., 20.	Vein puncture, May 25, '97.	No growth.....	Died on fifth day, became unconscious, with rising temperature and pulse—until death. Culture from cerebro-spinal fluid obtained by lumbar puncture gave no growth.
102. Peyer.....	76, m.; 30; baker..	Four days ago fell from bicycle, striking on head. No wound; not unconscious. Three days later convulsions, vomiting. When admitted, restless and unconscious. Temp., 101° F.; pulse, 60; resp., 30.	Vein puncture, May 12, '97.	In one tube a growth of Fraenkel's pneumococcus. Other tubes sterile.	Died on third day in hospital; unconscious. Temp., 108.5° F.; pulse, 150; resp., 50. No autopsy.
103. Hughes....	660, m.; 14; school.	Stiffness of muscles of neck. General hyperaesthesia; moderate dilatation of pupils. Temp., 102-3° F.; pulse, 70-80; resp., 26.	Vein puncture, Sept. 30, '97.	Tubes contaminated. One colony in each of two tubes; one a sarcina, the other a yeast.	In hospital thirty days. Cured.
104. Sheline	296, m.; 42; cigar-maker.	Chronic otitis media; headache; stiffness of muscles of neck; some muscular spasm; stupor; restlessness. Temp. very irregular, 104.5° F. to almost normal; pulse, 70-80.	Vein puncture, July 6, '97.	No growth.....	Paralysis of facial muscles of right side developed with increased tumor. Abscess of brain suspected, and the brain was explored, but no pus was found. In hospital fifty-eight days. Died. No autopsy.
105. Wagner....	491, m.; 22; laborer.	Headache; mental lethargy and weakness; loss of sensation, and partial loss of power in lower extremities; incontinence of urine and faeces. Temp., 100-2° F.; pulse, 72-80; resp., 20. Urine, normal.	Vein puncture, Aug. 17, '97.	No growth.....	In hospital thirty-two days. Cured.

ENDOCARDITIS, MALIGNANT.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
106. Kenigga ...	485, f.; 24; housewife.	Daily chills, headache, slight cough, vomiting; systolic murmur at apex. (Edema of legs. Signs of pleurisy and some consolidation of right lower lobe. Temp., 103-5° F.; pulse, 108-30; resp., 38-46.	Vein puncture. Aug. 14, '97.	In one tube three minute colonies of streptococcus pyogenes. Chains of considerable length in bouillon culture. Other tubes sterile.	Died on the second day. Autopsy. One cusp of mitral valve perforated and eroded, with masses of fibrin attached. Aortic valve covered with minute vegetations. Infarctions of spleen and kidneys, and cerebral hemorrhage. Cultures at autopsy from spleen and kidneys show an abundant growth of streptococcus pyogenes. No other bacteria found.
107 Broestler ...	40, f.; 19; housewife.	Double murmur and systolic thrill at apex. Systolic murmur at base. Complete hemiplegia of right side. Temp., 101.5-5° F. Urine: 1012; albumin, six per cent.; no casts.	Vein puncture. May 7, '97.	Minute grayish-white colonies in all of seven tubes. From one to fifteen colonies in each. A pure growth of Fraenkel's pneumococcus in each case.	Died on twenty-eighth day. Mitral valve covered with a thick fringe of vegetation, which extend upward on the anterior surface of left auricle, forming a thick patch; also downward on surface of ventricle as minute scattered tubercles. Cultures at autopsy from spleen, liver, and kidney. From spleen, two colonies of pneumococci. From liver, many colonies of pneumococci. From kidney, one yellowish colony of very large cocci.
108. Shannon ..	263, f.; 22; book-keeper.	Fever, irregular. Temp., 100-1° F., running at times to 102-3.5° F.; pulse, 100-10. History of rheumatism. Harsh systolic murmur at apex. Retinal hemorrhages repeated at irregular intervals. Also cerebral hemorrhage.	Vein puncture. July 7, '97.	Two tubes. Three minute grayish-white colonies of Fraenkel's pneumococcus.	In hospital forty days. Patient taken away by friends. Died at home.
	Second examination.		July 29, '97....	One tube. Abundant growth of Fraenkel's pneumococcus. No growth.	
109. Blake. ...	Third examination. 777, f.; 42; dress-maker.	Attacks of dyspnea. (Edema of extremities. Presystolic murmur at apex. Irregular heart-action. Moderate irregular fever, with a sudden rise to 104-5° F. two days before death.	Aug. 17, '97.... Vein puncture. Nov. 11, '97.		Died on tenth day. Autopsy. Extensive atheroma of coronary arteries. Embolism of superior mesenteric and both common iliac arteries. Necrosis of lung. Acute peritonitis. Infarctions of lungs. Thrombosis of left ventricle. No result was obtained by culture from the organs at autopsy.

complicating acute lobar pneumonia, obtaining his material by inserting a cannula into a vein, and he obtained a growth of the micrococcus lanceolatus. He concludes that this method of examination has some value in differential diagnosis, but that the absence of a growth of bacteria does not exclude malignant endocarditis.

Dreschfeld²⁶ says that the examination of the blood in these cases taken from a vein during life is generally negative, but that occasionally a growth of streptococcus pyogenes with malignant properties is obtained.

Kühnau³ examined 12 cases, and in only 1 of them, and then only immediately before death, obtained a culture of staphylo-coccus pyogenes aureus. This finding was verified by cultures made at autopsy.

Our cases number 3 of undoubted malignant endocarditis, and 1 in which the diagnosis was somewhat uncertain. In all of the first group, cultures were obtained during life from the blood. In 2 of them the micrococcus lanceolatus developed, and in the third, the streptococcus pyogenes. These 3 cases were all fatal. In 2 of them the result of the blood-culture during life was confirmed by cultures made from the various organs after death. Two of these cases (Nos. 107 and 108), in which the micrococcus lanceolatus was found, are fully described in Article XXIII., "Malignant Endocarditis," by Dr. James. In the fourth case (No. 106) the diagnosis of which has been spoken of as questionable, the blood-cultures during life were uniformly sterile. The case terminated fatally. The lesions found at autopsy, and which are described in the above table, leave it still somewhat uncertain as to whether or not the case was one of malignant endocarditis. Cultures made from the various organs failed to show the presence of any pathogenic bacteria.

We conclude then as follows:

1. That in malignant endocarditis of these two varieties, namely, streptococcus pyogenes and micrococcus lanceolatus, the living bacteria often exist free and are fairly widely distributed in the blood-current.
2. That this method of examination by cultures from the blood is of considerable value, not only in diagnosis of malignant endocarditis itself, but in the differential diagnosis between the different varieties of the disease.

MISCELLANEOUS DISEASES.

Our table includes a fairly large number of cases of miscellaneous diseases, selected generally because they showed fever and seemed possibly to be associated with some form of general infection.

Sittman and Barnow²⁷ took a specimen of blood from the median basilic vein of a case of cystitis, pneumonia, and general septic poisoning following stricture of the urethra. They found in the blood the bacillus coli communis, and at the autopsy growths of the same organism were obtained from the various viscera.

Hewes²⁸ claims to have cultivated the gonococcus three times from blood taken from nine cases of gonorrhœal arthritis.

Cannon⁶ claims to have succeeded in growing the influenza bacillus from the blood of cases of this disease.

Other observers, however, have failed to accomplish this. As will be seen by reference to our table of cases, in no one of this miscellaneous group did we obtain a positive result from the blood-cultures.

CONCLUSION.

Summing up the present investigation we conclude as follows :

1. That the attempt to cultivate bacteria from the blood of living persons is useless unless carried out in a painstaking way and with thorough antiseptic precautions, and by blood drawn directly from a vein.

2. That the number of diseases in which this procedure is useful is small.

3. That in malignant endocarditis it is of great value, in other septic diseases it is of moderate value, and in typhoid fever it may on rare occasions prove of some use.

In other morbid conditions its usefulness has not yet been proved.

NEPHRITIS, CHRONIC.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
110. O'Leary....	300, f.; 36; housewife.	Left hemiplegia, not complete, in leg. Heart normal. Temp. 104° F., rising with some remissions, to 103.5° F. Urine: small amount of albumin; no casts.	Vein puncture. July 8, '97.	One tube shows one colony of bacillus subtilis. Other tubes sterile.	In hospital ten days. Died. Cerebral hemorrhage.
111. Mernin....	305, m.; 51; tool-maker.	Comatose. Temp., 104.8° F.; pulse, 106; resp., 34. Right hemiplegia. Onset sudden.	Vein puncture. July 8, '97.	No growth.....	Died after three days. Uræmia. Cerebral hemorrhage.
112. Manuel....	176, m.; 22; cook..	Pain and swelling in left knee. Edema of feet and legs. Urine; 1020-30; albumin, large amount; granular and hyaline casts. Temp. very irregular, 99-102° F.; pulse, 80-90; resp., 24.	Vein puncture. Aug. 4, '97.	No growth... ..	In hospital eighty-six days. Improved. Hydrarthrosis.
113. Burke.....	823, m.; 45; time-keeper.	Irregular fever, gradually rising. Pulse, rapid and feeble. Dulness and subcrepitant râles over left lower lobe. Urine contained a little albumin and a few granular casts.	Vein puncture. Nov. 23, '97.	No growth.....	On admission patient was suffering from alcoholism and illuminating-gas poisoning. Death on the tenth day. Autopsy showed chronic nephritis. Atelectasis of both lower lobes with hemorrhagic infarctions on left side. Fat-necrosis in and around the pancreas.
114. Anderson ..	46, m.; 39; carpenter.	Chronic nephritis. History of rheumatism. Has dyspnoea, cough, palpitation. Edema of legs. Heart, hypertrophied, but no murmurs heard. Urine, specific gravity, 1020-30. Small amount of albumin; few granular casts. Temp. irregular; at times, 102-3° F., but generally 99-100° F.	Vein puncture. June 14, '97.	No growth.....	In hospital fifty-six days. Died. Cardiac hypertrophy and dilatation.
115. Stedneyer.	182, f.; 40; housewife.	Nephritis, acute. Uræmia. Patient very corpulent. Some hæmatemesis. General hyperæsthesia. Dyspnoea. Temp. irregular, 100-3° F.; pulse, 100-10. Urine: 1030; large amount of albumin; granular and hyaline casts.	June 25, '97..... Vein puncture. July 6, '97.	No growth.. No growth.....	For four days before death, temp. 103-4° F. Complications: cirrhosis of liver, pleurisy with effusion. Died after twenty-nine days.

ENDOCARDITIS, CHRONIC.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
116. Stump.....	649, m.; 35; conductor.	Double murmurs at base and apex of heart. Sibillant and sonorous rales over both lungs. Some areas of dulness, with increased vocal fremitus. Temp., 102-4° F.; pulse, 100; resp., 28-36.	Vein puncture. Sept. 26, '97.	No growth.....	In hospital thirty-one days. Cured of acute bronchitis and broncho-pneumonia.
117. Thedweld..	150, f.; 29; housewife.	Chronic nephritis. Urine: 1013; very large amount of albumin; granular and hyaline casts, (Edema. Necrosis of bones of nose and hard palate. Mitral systolic murmur. Irregular, moderate fever.	Vein puncture. June 14, '97.	No growth	Patient was in tertiary stage of syphilis, with progressive lesions. Died after eighteen days. Autopsy. Cardiac hypertrophy and dilatation. Acute lobar pneumonia in very early stage. Kidneys very pale.
118. Becket....	288, f.; 25; domestic.	Purpura hemorrhagica. Double murmurs at apex and base. Dyspnoea. Crops of abundant petechial spots. Temp. moderate and irregular.	Vein puncture. July 8, '97.	No growth... ..	In hospital four months and ten days. Died. Autopsy showed adherent pericardium; tricuspid valve thickened; two projecting red nodules on one of the cusps. Aortic and mitral orifices much stenosed. Cusps thickened and fringed with minute vegetations.
119. Gross.....	26, f.; 27; housewife.	Dyspnoea. Area of cardiac dulness increased. Double thrill and murmur at apex. Liver and spleen enlarged. Edema of legs. Fluid in pleural and abdominal cavities.	Aug. 6, '97. Oct. 2, '97.....	No growth. No growth.....	Cultures at autopsy from spleen and liver. Spleen, no growth. Liver, three colonies of bright yellow saccharine, and three colonies of Fraenkel's pneumococcus.
120. Lawson....	Second examination. 274, f.; 44; housewife.	Moderate irregular fever. Double Headache, dyspnoea, cough. Double mitral murmur. Fluid in left chest. Temp. irregular, running to 102° F.; pulse, 120-40. Urine: small amount of albumin; few granular casts.	Vein puncture. May 12, '97. June 14, '97 Vein puncture. July 7, '97.	No growth..... No growth..... No growth	In hospital sixty-three days. Died. Autopsy. Mitral valve much thickened. The orifice is a button-hole slit just admitting the tip of the little finger. Pneumonia of heart disease. Infarctions of lungs.
121. Ross.....	528, m.; 24; waiter.	Rheumatism. Double murmurs over aortic and mitral valves. Cardiac hypertrophy. Aneurism of radial artery. Temp. irregular, 99-102° F.; pulse, 100-10; resp., 28.	Vein puncture. Oct. 23, '97.	No growth... ..	In hospital twenty-one days. Cured of acute bronchitis and pleurisy with effusion.
					In hospital one hundred days. Died. No autopsy.

MISCELLANEOUS DISEASES.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
122. Beacroft...	756, m.; 20; student.	Multiple neuritis. Paralysis of diaphragm and upper and lower extremities. Temp. normal.	Vein puncture. Nov. 6, '97.	No growth.....	Gradual return of power in extremities. Recovery of diaphragm very slow. In hospital forty-four days. Cured.
123. Conlin.	122, m.; 26; stableman.	La grippe. Headache, malaise. Loss of appetite. Pain in abdomen. Constipation. Temp., 102° F.; soon falling to normal. Urine, negative.	Vein puncture. May 25, '97.	No growth	In hospital nine days. Cured.
124. O'Connell..	161, m.; 56; laborer.	Multiple abscesses. Purpura hemorrhagica. Four weeks ago both ankles, both knees, and right shoulder and elbow became swollen and tender, following an infected wound of hand. Some abscesses about feet and legs. Purpuric spots on legs. Temp. not above 101° F., irregular; pulse, 80-112. Urine, negative.	Vein puncture. June 4, '97.	No growth.....	In hospital fifteen days. Cured.
125. Wallace....	435, m.; 63; none..	Cystitis, pyelitis. Double aortic murmur. Marked thickening of walls of arteries. Crepitant and subcrepitant râles over both lungs. Dulness and broncho-vesicular breathing at left apex. Temp. irregular, 101-4.5° F.; pulse, 110-40; resp., 36-40. Urine: 1010; considerable albumin; few casts; pus. Pyelonephritis. Chilly sensations. Malaise. Nausea and vomiting. Right kidney enlarged and tender. Urine: 1020; some albumin; much pus. Temp., 103.5° F.; pulse, 110; resp., 28.	Vein puncture. July 30, '97.	No growth.....	Died after thirteen days. Autopsy: showed cystitis, double pyelonephritis, atheroma and fusiform dilatation of the arch of aorta.
126. Poole.....	656, m.; 38; nurse	Subdiaphragmatic abscess. Pain and tenderness in right side of abdomen. Temp., 101.5-3.5° F.; pulse, 100; resp., 30.	Vein puncture. Sept. 30, '97.	No growth.....	In hospital thirty-two days. Cured.
127. Schein.....	95, m.; 27; operator.	Carcinoma of omentum and pleura. Flatness over right side of chest from second intercostal space to base. Voice absent in lower part. Abdomen distended and tympanitic. Irregular nodular masses felt. Temp. normal.	Vein puncture. May 20, '97.	No growth.....	In hospital forty-two days. Cured by operation.
128. Ford.	F.; 65; housewife..	Malaria of tertian type. Severe chills, with temp. of 105.5° F. Plasmodia found in blood.	Vein puncture. June 14, '97.	No growth.....	Died after eleven days. Autopsy. Mass of new growth in pelvis also.
129. Fleig	724, m.; 24; butler.		Vein puncture. Oct. 23, '97.	No growth.....	In hospital nineteen days. Cured. No complications.

130. Gallyuly....	199, m.; 37; painter.	Tertiary syphilis. Subperiosteal gumma of skull. Headache. Swelling and tenderness in right temporal region. Temp. very irregular, 101-99° F.; pulse, 78-88. Initial lesion fifteen years ago.	Vein puncture. June 14, '97.	No growth.....	In hospital sixteen days. Improved.
131. Pilegio....	M.; 21; laborer....	Traumatic tetanus following a wound of sole of foot. General tetanic spasms. Temp., 100-99° F.	Vein puncture. May 9, '97.	No growth.	Died after two days.
132. Heyman....	232, m.; 17; baker.	Suppurating prepatellar bursitis. Erysipelas.	Vein puncture. June 21, '97.	One tube contaminated. Bacillus subtilis. Other tubes sterile.	In hospital four days. Improved.
133. Tee	134, m.; 60; agent.	Cirrhosis of liver. Ascites. Some jaundice. Dyspnea. Urine, normal.	Vein puncture. June 21, '97.	No growth.....	In hospital fifty-one days. Died.
134. Wiley.....	184, f.; 40; dress-maker.	Pyosalpingitis. Pelvic peritonitis. Pain and tenderness in left iliac region. Chilly sensations. Mass to be felt by vagina; very tender. Irregular temperature up to 102° F.	Vein puncture. June 9, '97.	No growth.....	In hospital eighty days. Cured.
135. Neilson....	84, f.; 37; seamstress.	Pyosalpingitis on left side. Chills, followed by sweating. Pain in left inguinal region and running down left thigh. Temp., 101-2.5° F.; pulse, 90-100.	Vein puncture. May 17, '97.	No growth.....	In hospital four days. Not improved. Refused operation.
136. Weinstein..	M.; 21; tailor	Sarcoma of lung and pleura.....	Vein puncture. May 14, '97.	No growth.....	In hospital ninety-three days. Died.
137. Brown.....	614, m.; 31; cabinet-maker.	Abscess of liver. Peritonitis. Ulcerative colitis. Pain in right side. Dulness over lower part of right chest, with bronchial voice and breathing. Temp., 102-103.5° F.; pulse, 100; resp., 30-40.	Vein puncture. Sept. 23, '97.	No growth.....	Died on eighteenth day. Exploring-needle obtained no pus. Autopsy showed an abscess in right lobe of liver, ulceration. Ulcerative colitis and hemorrhage into the intestine.

MISCELLANEOUS DISEASES.

Case No. and Name.	Hospital No., Sex, Age, Occupation.	Clinical Features and Stage of Disease.	Method and Date of Taking Specimen.	Result of Culture.	Remarks, Course, Duration, and Result.
138. Berringer ..	19, f.; 39; janitress.	Calculus in common duct. Abscess of liver. Temp. irregular, 101-6.5° F.; pulse, 100-20; resp. 30-35. Jaundice.	Finger puncture. May 1, '97.	Growth of staphylococcus pyogenes albus in one tube. Other tubes sterile.	Died on fifth day.
139. Schum	860.....	Abscess of liver. Temp., 103.5° F.; very regular; pulse, 90-100. Emaciation. Weakness.	Vein puncture. Dec. 7, '97.	No growth.....	Patient refused operation, and died.
140. King	Second examination.	Moderate leucocytosis. Pus obtained with exploring needle.	Dec. 27, '97 ...	No growth.	
	Bellevue Hospital, m.; 35; laborer.	Sick since Dec. 20. Loss of flesh, cough, night-sweats. Some dyspnoea. Signs of general bronchitis. Chill, Jan. 3, '98. Temp., 105.4° F. in evening; 106° F. in morning.	Vein puncture. Jan. 6, '98.	No growth.....	Still in hospital.
141. Van Patten.	F.; 22; housewife.	Miscarriage at five months, nine days ago, with placenta prævia. Condition good for seven days, when she developed rigidity of muscles of jaw and neck. Now all muscles of body involved. Temp., 106.2° F.; pulse, 142; resp., 28.	Vein puncture. Jan. 1, '98.	No growth.....	Died one day after admission. The uterus contained much necrotic tissue, and there was a profuse discharge of pus. No autopsy. Examination for tetanus bacilli not completed.
142. Coghlan ...	848, f.; 39; domestic.	Rapid, irregular heart-action; faint double murmur at apex. Dyspnoea. Cyanosis. General oedema. Petechæ on skin.	Vein puncture. Dec. 8, '97.	One tube shows two large white colonies of very large cocci, and several minute colonies of diplococci. All contaminations.	Died. Autopsy showed an adherent pericardium. Stenosis of mitral orifice; admits tips of two fingers. Valve-flaps thickened, and edges fringed with minute vegetations. Hydrothorax. Nephritis.
143. Colofiga ..	Second examination. Third examination. Bellevue Hospital, f.; 35; domestic.	Moderate, irregular temperature..... Pale, anæmic. Swelling of feet and ankles. Purpuric spots on skin and mucous membranes. Blowing systolic murmur at apex. Irregular fever; chills every day. Herpes labialis. Red blood-cells, 1,332,000; white blood-cells, 16,000. Hæmoglobin, twenty-eight per cent.	Dec. 13, '97..... Dec. 16, '97..... Vein puncture, June 29, '97.	No growth. No growth. No growth.....	Died at the end of five months. Autopsy. Spleen large and congested. The other organs in fair condition.

TABLE OF REFERENCES.

The following is a list of the most important of the publications that have been referred to in the above paper. It does not claim to be a complete reference-list of the literature of the subject. For a more nearly complete schedule the reader is referred to the paper by Kühnau, *Zeitschrift für Hygiene und Infektionskrankheiten*, Bd. XXV., s. 482, 1897.

1. MEISELS : *Wien. Med. Woch.*, Nr. 21-23, 1886.
2. STAGNITTA : *Rev. Baumgarten Jahresbericht*, s. 219, 1890.
3. KÜHNAU : *Zeitscht. f. Hyg. und Infctskhtn.*, Bd. XXV., s. 492, 1897.
4. D'ESPINE ET MARIGNAC : *Arch. de Med. Exper. et Anat. Path.*, vol. iv., p. 458, 1892.
5. BOMMERS : *Deut. Med. Woch.*, s. 552, 1893.
6. CANNON : *Deut. Med. Woch.*, Nr. 43, 1893. *Deut. Ztscht. f. Chirurgie*, Bd. XXXVII., Hft. 5 u. 6, 1894.
7. AVETRANI : *Rev. Sem. Med.*, Apr. 16, 1897.
8. GAFFKY : *Mitth. aus d. Kais. Gesundheitsamt*, Bd. II., 1884.
9. R. STERN : *Sammlung klin. Vort.*, N. f. 138.
10. BANTI : *Reforma Med.*, p. 674, 1894.
11. NEUHAUS : *Berlin. klin. Woch.*, 1886.
12. FRAENKEL UND SIMMONDS : *Centblt. f. klin. Med.*, s. 737, 1885.
13. ALMQUIST : *Rev. Baumgts. Jahresbericht*, s. 145, 1887.
14. SEITZ : *Bacteriologische Studien zur Typhus Ätiologie*. Muenchen, 1886.
15. LUCATELLO : *Rev. Baumgts. Jahresbericht*, s. 176, 1886.
16. RUTIMEYER : *Centblt. f. klin. Med.*, Nr. 9, 1887.
17. WIDAL UND CHANTEMESSE : *Rev. Baumgts. Jahresbericht*, s. 150, 1887.
18. WILTSCHOUR : *Rev. Centblt. f. Bact. und Parasitkde*, s. 279, 1890.
19. PASQUALE : *Rev. Baumgts. Jahresbericht*, s. 249, 1891.
20. THIEMISCH : *Deut. Med. Woch.*, Nr. 34, 1895.
21. ORTHENBERGER : *Muench. Med. Woch.*, Nrs. 49, 50, 1888.
22. WEICHELBAUM : *Wien. Med. Jahrbücher*, 1888.
23. QUEISSNER : *Jahrbch. f. Kinderheilkunde*, Bd. XXX., 1889.
24. FAULHABER : *Zeigler's Beiträge*, Bd. X., s. 7, 1891.
25. GRAWITZ : *Beiträge zur Bacteriologie des Blutes*. *Charité Annalen*, Bd. XIV., s. 154.
26. DRESCHFELD : *British Medical Journal*, vol. ii., p. 1564, 1895.
27. SITTMAN UND BARNOW : *Deut. Arch. f. klin. Med.*, Bd. LII., Heft 4, 1893.
28. HEWES : *Boston Medical and Surgical Journal*, vol. cxxxi., p. 104, 1894.

VI.

UNUSUAL COMPLICATIONS OF ENTERIC FEVER.

I. SUPPURATIVE THYROIDITIS. II. PURPURA. III. ECZEMA. IV. NEURITIS OF ARMS. V. ACUTE CARDIAC DILATATION.

BY W. GILMAN THOMPSON, M.D.

THE following notes on some of the rarer complications of enteric fever are interesting as illustrating the multifarious phenomena of the disease.

I. *Thyroid Abscess*.—The patient, a German servant-girl, aged nineteen, was admitted to the hospital at the beginning of the second week of enteric fever. Her illness began with rigors, frontal headache, epistaxis, prostration, and fever, and she subsequently developed an enlarged spleen and an abundant typical typhoid eruption. The temperature reached a maximum of 105.2° F., and the fever lasted twenty-eight days, being characterized by extensive fluctuations under treatment by cold tub-baths, the thermometric range sometimes amounting to 5° F. in a day. Three days after a normal morning temperature was reached, at the close of the fourth week, the patient gave signs of recrudescence, and the temperature rose to 102.5° F. Careful examination revealed no complications until at the end of the thirty-eighth day of illness, when pain, tenderness, and swelling were observed over the thyroid gland. The swelling was bilateral, but was much more pronounced upon the right side. Fluctuation was doubtful, but as the other signs of abscess increased, five days later the patient was etherized and three and one-half ounces of pus were evacuated from the substance of the gland. The temperature immediately fell to normal, the wound was dressed with iodoform drainage, and the patient made complete recovery in ten days. Typhoid bacilli were not discovered in the pus.

I believe this to be an extremely rare complication. Colzi* reports a similar case occurring after an attack of typhoid fever in a

* La Semaine Médicale, August 19, 1892.

young man who had a goitre which had previously given but little annoyance. A few other cases have been reported, and Kinnicutt* briefly mentions its exceptional occurrence in a gland previously healthy, such as appeared in the case above detailed.

II. *Purpura Hemorrhagica*.†—The patient, a male, German, aged twenty-four, was admitted to the hospital on the ninth day of an attack of enteric fever, during the service of Dr. G. P. Tuttle, continued during my own. The patient gave no rheumatic personal history, but his father had suffered from rheumatism. He was a beer-bottler by trade, and a copious beer-drinker by habit, drinking seven or eight glasses a day. His previous health had been excellent. He complained, on admission, of having been ill for nine days with frontal headache, epistaxis, weakness, fever, and diarrhœa, but he had been working until he entered the hospital.

On examination he appeared neither anæmic nor emaciated. The temperature was 104° F.; pulse, 90; respiration, normal. The Widal reaction was obtained. The urine was normal. The skin was somewhat hyperæmic, and a number of typical enteric spots were present upon the abdomen, lower chest, and arms. The spleen was barely palpable, and the liver appeared an inch below the costal margin. No other visceral abnormalities were discoverable. There was moderate alcoholic tremor. Two days after admission severe epistaxis returned, which the house-physician, Dr. Carter, was only partially able to control by plugging and the use of styptics. At this time a number of small hemorrhagic spots appeared scattered over the back, and upon the left forearm. The dejecta were slightly streaked with blood. During the next three days the patient became excessively weak from loss of blood, and during the period from the ninth to the twentieth day of the disease, he showed no improvement. The temperature rose to 105.6° F., and remained steadily high (104.5–5° F.). The urine became hemorrhagic, showing red blood-cells, hæmoglobin, leucocytes, hyaline casts, and albumin, thirty-five per cent., by volume. Well-marked Ehrlich reaction was present. Subconjunctival hemorrhage took place in the left eye, and the ecchymoses became abundant over the back, chest, abdomen, and extremities. They were also observed on the buccal mucous mem-

* The American System of Practical Medicine, vol. iii., p. 663.

† I am indebted for many of the details of this history to the late house-physician, Dr. Herbert Swift Carter, and to the kind permission of Dr. G. P. Tuttle to refer to it.

brane, and small necrotic patches appeared on both anterior pillars of the fauces, and upon the uvula. Signs of moderate bronchial catarrh were noted, together with pleuritic râles heard in the left axilla. The tongue became dry and fissured, there was bleeding from the gums, and the breath was foul. The patient was very restless, delirious, and finally semicomatose. Subsultus was prominent, with general tremor of the entire body at times. During the fourth week of the disease there was no increase in the purpuric spots, many of which began to fade, but the other symptoms continued, with occasional attacks of epistaxis. Slight hemorrhage also occurred from the left ear. For sixteen days the maximum temperature daily reached 105.5°F. , with fluctuations of one or two degrees produced by cold sponge-baths. During the fifth and sixth weeks slight improvement gradually supervened, the urine became less hemorrhagic, epistaxis ceased, and on the forty-second day of the disease the morning temperature reached the normal for the first time. Ten days later moderate recrudescence occurred (103°F.), lasting for three days. By the fifty-seventh day the temperature became subnormal, and so remained for a fortnight, at times falling as low as 97°F. , and on the seventy-third day the patient had wholly convalesced. No cultures were obtainable from the blood at any time.

One hundred and nine sponge-baths were given. Ergot and turpentine were employed to control the hemorrhage; whiskey, strychnine, and digitalis were freely given as occasion required.

Hemorrhagic purpura is another very rare complication of enteric fever, and recovery is equally rare. It is interesting to note the early appearance (on the eleventh day of the disease) of the ecchymoses, and the absence of any chronic visceral lesions. The combination of moderate alcoholism, with the evident severity of the enteric infection were apparently the only etiological factors.

III. *Papular eczema* was observed in a young man aged twenty-four in the course of an attack of enteric fever of moderate severity. The temperature at no time exceeded 104.4°F. , and no complications appeared until the end of the fourth week, when with subsidence of the febrile state there suddenly developed a most extensive papular eczema, involving practically the entire body. The eruption lasted for ten days, gradually subsided, and apparently had no effect in retarding convalescence.

IV. *Neuritis of Arms*.—It is often claimed by the opponents of the Brand system of cold tub-bathing for enteric fever, that the constant application of the cold water tends to excite neuritis, although it is well known that this complication occurs often in patients otherwise treated. In the 139 cases collected by Dr. J. P. Thornley, and published in Vol. II. (p. 177 *et seq.*) of the Report of the Presbyterian Hospital, which were treated by the Brand method, but 4 cases (three per cent.) of neuritis were observed. Of these, 2 occurred in enteric fever, complicated with malaria, and the number of baths given in each of the 4 cases were, respectively, 55, 72, 11, 67. Dr. Thornley's table also includes 61 cases treated by cold sponge-baths, and among these but 1 case of neuritis is recorded, and this in a patient who had received but 7 such baths. Many other patients receiving tub-baths ranging from 60 to 130 in number, never developed neuritis, so that any direct relation between the cold application and neuritis is highly improbable. The neuritis commonly observed in enteric fever under this treatment is, in my experience, confined chiefly to the lower extremities, and the pains are most severe in the heels, soles of the feet, and calves of the legs, although they may be exceptionally more general. The neuritis lasts from four or five to fourteen days, and complete recovery then follows. I have seen but one case in which it was confined to the arms. This patient was a male, German, aged thirty-two, who was admitted to the hospital, August 6, 1897, on the fourth day of his illness. He was a moderate beer-drinker, giving no appearance of alcoholism. He had a typical attack of enteric fever of ordinary severity, lasting forty-two days, including a mild recrudescence. For only three days did the temperature rise above 103° F., once reaching 104.5° F., and most of the time it ranged between 101° and 102° F. The Widal reaction was present, together with an enlarged spleen and a rather copious rose rash. On the twenty-fifth day of his illness the patient first complained of pain in the muscles of the right arm, which in a day or two involved the muscles of both shoulders, arms and forearms, especially the flexor surfaces. There was decided tenderness along the nerves of both arms, with moderate loss of power. The pain became so intense as to prevent all attempt at voluntary movement and interfered with sleep. No other nerves aside from those of the arms and shoulders were involved, and in two weeks the complication was completely recov-

ered from. The local treatment, which was found to give much relief, consisted of frequent applications of the following lotion :

R̄. Menthol,	
Chloral.....	℥ 3 ii.
Aquæ camphoræ,	
Alcohol.....	℥ 3 ii.

Only fifteen tub-baths were required in this case, and no baths at all had been given for fifteen days prior to the first appearance of the neuritis. The history is chiefly interesting from the appearance of a neuritis in so mild a case of enteric fever, and which was restricted to a much less common site than the usual one in the legs.

V. *Acute cardiac dilatation* with tachycardia occurred suddenly at the close of the fourth week of enteric fever in one patient. He was admitted during the first week, and the maximum temperature was 105.5° F. Thirty-six cold tub-baths were given and the patient was apparently approaching convalescence when the pulse suddenly rose to 160 and the respiration to 38. He complained of intense dyspnœa, and the heart, previously normal, was found to present the apex in the mid-axillary line, with corresponding increase in area of dulness and a mitral systolic bruit. The lungs became congested at the base. Strychnine, digitalis, and nitroglycerine were freely given, and gradual improvement followed, so that at the end of ten days the heart had returned to its original size and the pulse became normal. The complication occurred without any discoverable exciting cause, the patient having made no exertion and having received no mental shock. For fully forty-eight hours his condition was exceedingly critical—apparently hopeless, but he made an excellent recovery.

VII.

A REPORT OF TWO DERMATOLOGICAL CASES COMPLICATING CARDIAC DISEASE.

BY GEORGE THOMAS JACKSON, M.D.

ON November 9, 1897, I saw in consultation at the Presbyterian Hospital, through the courtesy of Drs. W. G. Thompson and W. P. Northrup, the following cases, photographs of which were kindly taken by Dr. C. W. Stevens:

CASE I. *Purpura.*

Mary B., aged twenty-five; single; German. Up to eight years ago she was well. At that time she was attacked with rheumatism in the knees, ankles, and hands, and was in bed with it for three months. She had a second attack of rheumatism four years ago, the same joints being involved, with the addition of the shoulder joints. She recovered from this and was well until May, 1896, when she had a third attack of rheumatism, from the effects of which she has never recovered, suffering since then with constant cardiac pain and palpitation. During June of this year her feet and legs have swollen a great deal.

On admission, July 1, 1897, according to the hospital notes, there were marked irregularity and increased rapidity of heart action, presystolic and systolic murmurs over mitral area, and a systolic murmur over the pulmonary area; increased area of cardiac dulness, and some fluid in both sides of the chest.

On August 10 the patient was given four grains of iodide of potassium three times a day.

On August 11 a diffused petechial eruption appeared on the lower extremities. The iodide was stopped, and the next day the eruption had faded. On September 2, with an exacerbation of pain, a fresh hemorrhagic eruption took place on the legs, thighs, and lower part of abdomen.

From this time until the day of her death, November 10, she was never free from the eruption, fresh hemorrhages into the skin

taking place on different days, sometimes coincident with a rise of temperature and exacerbation of pain. On October 24 a fresh eruption is noted as very profuse, with great œdema of the legs.

On November 6 it is noted that the entire lower extremities, lower part of abdomen, and to some extent the upper extremities, were involved in a diffused bright red hemorrhagic eruption, in some places discrete, in others confluent, but always beginning as petechiæ.

On November 9 I first saw the patient. She presented an appearance very unlike that usually seen in purpura. Not only were there petechiæ, as in the common form, and also some ecchymoses, but large patches that looked as if a bright-red color had been flowed over the skin, and then a darker red flowed over that in part, but not sufficiently to cover the brighter red. This was seen upon the legs below the knee.

The patient died on November 10. Throughout her stay in the hospital there was albumin constantly in her urine in varying amounts up to twenty-five per cent., and some casts.

Purpura occurs under very many conditions. In the case now under consideration it was probably due to her heart disease and the attendant embarrassment of the circulation of the blood and hy-
dræmia.

CASE II. *A Vesicular and Bullous Dermatitis Medicamentosa, Due to Iodide of Potassium.*

Joseph R., aged twenty-four; married; American. He was admitted to the hospital on August 26, 1897, on account of endocarditis chronica and congestion of the liver and spleen. He had been a steady drinker. His urine contained ten per cent. of albumin and some casts; his temperature ran along at about 100° F. to 102° F. during his stay in the hospital.

On October 1 symptoms of rheumatism showed themselves, and on the sixteenth of the month he was given five drops of a saturated solution of iodide of potassium, t. i. d.

On October 19 a vesicular eruption appeared on the infraorbital regions and across the bridge of the nose. The nature of the eruption not being suspected on account of the small amount of iodide he had taken before it appeared, the medication was continued, and the eruption spread gradually, so that when I was asked to see him,



CASE I.

on November 9, the eruption involved the parts under the eyes, the bridge of the nose, the forehead, cheeks, ears, lips, and backs of both wrists. By this time not only were there vesicles, but also bullæ.

The diagnosis of dermatitis medicamentosa, due to iodide of potassium, was made, the drug stopped, and the eruption at once began to fade, drying into crusts that fell off and left brownish stains. The patient's general condition grew steadily worse, and he died on December 3.

This was a typical iodide eruption. The dermatitis due to iodide is very manifold in form, and one of them is the vesicular-bullous eruption met with in this case. It is not necessary for a susceptible individual to take large doses to cause it; indeed, it may appear after only a few grains are taken. It begins as a vesicular eruption, but the neighboring vesicles have a strong tendency to coalesce and form bullæ, and the bullæ thus formed not infrequently assume the long, drawn-out shape seen in this case. The eruption is also most apt to appear on the face, and then on the backs of the hands and wrists, the locations so often affected in erythema multiforme. What makes this case still more typical is that the patient was suffering with heart disease; many, if not most, of the cases of this kind occurring in patients with heart disease. It is supposed that the weakness of the circulation and the insufficient action of the kidneys interfere with the elimination of the iodide and allow it to accumulate in the tissues; or, perhaps, the skin, in trying to help out the insufficient elimination of the kidneys, is irritated by the iodide, and reacts in this way.

It is a good rule to think of the possibility of some drug being the cause of any eruption presenting features unusual in the course of well-known dermatoses. In very many such cases inquiry will disclose the fact of some drug being taken.

VIII.

THE MALARIAL FEVERS OF NEW YORK CITY.

BY FRED P. SOLLEY, M.D.,

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AND

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EX-HOUSE PHYSICIAN.

LAVERAN says of malaria: "Paludism is certainly the most widespread of the endemic diseases, and at the same time one of the most severe. The study of its distribution over the surface of the globe is therefore of great scientific interest, as well as of great practical importance."¹*

As our knowledge advances, the geography of infectious diseases requires frequent revision. This is particularly true of the malarial fevers, because of the variations exhibited from time to time in their character and prevalence in different localities. With the diagnostic aids now at our command it is possible to differentiate the true malarial infections from other febrile conditions with which they have long been confused. Furthermore, we are able, by the same methods of investigation, to determine the special type or types of malarial fever occurring in any given locality. The value of accurate records based on such investigations in the regions where malaria prevails is obvious. Since the recognition of the parasite described by Laveran as the cause of malarial fevers, much has been done in this direction in all parts of the world, but a vast amount of work remains to be accomplished before the gaps in our knowledge of the nature and distribution of this disease can be filled. It is unnecessary to enter here into the history of Laveran's discovery and the work done by the Italians and others in differentiating the varieties of the parasite at present recognized by most observers. Reviews of the literature, with complete bibliographies up to the year

* The figures refer to the Bibliography at the end of this article.

1895, may be found in the treatises of Laveran,¹ Mannaberg,² and Thayer and Hewetson.³

So far as is understood at present, malarial fever everywhere seems to depend on the presence in the blood of parasites belonging to three distinct varieties, *viz.*, the tertian, the quartan, and the æstivo-autumnal. The malignant malarial fevers of hot countries depend on the latter form, as is shown by accounts thus far rendered, with the exception of those of Friedrich Plehn⁴ and Fisch,⁵ who claim to have found a special organism in "Blackwater fever." This claim as yet lacks sufficient support.

Our investigations in the malarial fevers of New York City were undertaken with the idea of contributing to the geography of these diseases. It may be well, therefore, to review here the distribution of malaria throughout the world.

GEOGRAPHY OF MALARIA.

The following outline is based on the writings of Laveran^{1, 6} and Thayer,⁷ with additional references to articles dealing with the parasitology of the various regions which have appeared during the past three years.

Thayer says in general: "Tertian fever is common in almost all malarial regions. Quartan is rare in many districts where the other forms of infection are frequent. In the United States quartan fever appears to be rare. On the other hand, there are certain regions in which quartan fever is particularly common, as the neighborhood of Pavia in Italy and in certain parts of Sicily. The types of fever are the same wherever they exist. In tropical countries the severer types of æstivo-autumnal fevers are in excess. As one passes away from the equator only the mild tertian and quartan fevers are seen in the earlier part of the season, while the æstivo-autumnal fevers appear in the late summer and early autumn. Lastly, where malaria is very uncommon, the milder forms, tertian and quartan fever, alone prevail."

It should be stated here that Laveran still adheres to his original idea of the unity of the malarial parasites. In March, 1897, he wrote, in concluding his account of the distribution of malaria:⁶ "A single disease susceptible of taking different clinical forms; a single polymorphic parasite—this is the conclusion that forces itself upon one."

EUROPE.

Great Britain and Ireland.—The milder infections, formerly common about London, in the “Fen District,” and in Ireland, have now almost disappeared. Relapses of tropical fever are often observed, however, in cases coming from the colonies to England, and characteristic organisms have been found in the blood.^{8, 9, 10}

Holland and Belgium.—Here also malaria was rife at one time, before the great system of dykes and canals was perfected, but is now much less frequent.

Germany.—Milder forms exist at the mouths of the Elbe and Weser, and at other points on the coast of the Baltic, especially in Pomerania. Silesia also affords a few cases. Strasburg was once the seat of severe malarial infections, but with better drainage and sanitation such fever is now rare. The tertian is the most common form observed in Central Europe. Ziemann¹¹ has made an elaborate study of the chromatin figures in the nucleus of the tertian parasite as it occurs in Germany.

Denmark and Sweden.—Mild forms occur at certain points on the coast and around Stockholm. Malaria is unknown in Northern Sweden, Norway, Iceland, and Northern Russia (above 60° N. latitude).

Russia and Turkey.—Along the Baltic, below the 60th parallel, mild forms are found, while about the Black, Caspian, and Azov Seas, and along the Volga and Danube Rivers, severe types prevail. In Bulgaria, Roumania, Moldavia, and Wallachia, the Caucasus and the valleys of the Balkan Peninsula, the fevers are common and severe.

The work of Danilewsky, of Kharkov, in Comparative Parasitology is well known. He believes the infections in birds and man are due to the same, or, at least, to closely related organisms.¹²

Sacharoff,¹³ in Tiflis, has also been an important contributor to the literature of the malarial parasite. He published, in 1895, an article with drawings and photomicrographs to show the identity of the flagella with the chromosomes in the hæmatozoon of birds. In a recent article, from a study of the comparative parasitology of birds and man, he is led to believe that the æstivo-autumnal infection is essentially a “marrow fever.” He considers the various appearances of the æstivo-autumnal parasite to be due to the fact that this organism develops in the “hæmatoblasts” in the bone marrow.

If the young parasite enters a nucleated red cell, it feeds first on the paranuclein (as in birds), later on the hæmoglobin, and becomes a crescent. If, however, the red cell is invaded after it has lost its nucleus, the parasite feeds on hæmoglobin only, and becomes a hyaline or slightly pigmented form.

Lewkowicz,¹⁴ in Krakov, has studied the parasites in 19 cases of malignant malarial fever, in many tertian and a few quartan infections. He believes that his observations have demonstrated that the tertian and quartan organisms develop within the red cells, while those of malignant fever are extra-globular. The latter fact he thinks would account for the crescentic forms, and also for the adhesion of the infected red cells to the vessel-walls in the internal organs.

Kirikoff,¹⁵ in St. Petersburg, has studied the parasite in cases occurring in that city.

Greece.—Severe infections prevail on the coasts and islands of Greece. In this country malarial fevers form nearly a third of all diseases. Of these, quotidian forms are four times as frequent as tertian. Organisms have been studied by several observers.⁶

Austria.—Along the lower Danube, in Hungary, severe infections are common. Higher up along that river the mild types are the ones chiefly seen.

Mannaberg,² in Vienna, has made an exhaustive study of the malarial parasites. Jancso and Rosenberger¹⁶ report an epidemic in Klausenburg in Hungary in 1894. Of 135 cases of malaria the blood was examined in 94. Seventy-three of these showed the presence of organisms; 5 were cases of quartan infection, 62 of tertian, and 6 of æstivo-autumnal infection.

Italy.—Severe types prevail in the lowlands along the coasts of Italy, Sicily, and Sardinia, and along the banks of the Tiber and the Po. The Pontine marshes and the Roman Campania are especially infested. In the more elevated regions the rice-fields are mainly responsible for malarial infections, especially where irrigation without adequate drainage is practised.

It is to the work of the Italian investigators that we owe most of our knowledge of the life-history of the malarial parasites. Bacelli,¹⁷ in some recent articles, has given a summary of the subject, and a discussion of malarial hæmoglobinuria, which will be considered in discussing the "Schwarzwasserfieber" of Africa.

France.—The mild tertian and quartan forms are the ones usu-

ally met with, though severe infections do occur, especially along the coasts, at the mouths of the rivers, where salt and fresh waters mix. At Dombes and Salignes, in the interior, where the fevers were once severe, drainage and sanitation have caused them to disappear almost entirely. Severe infections occur in Corsica, and Laveran has found organisms in the blood of cases from this island. He has also demonstrated their presence in infections originating in France,⁶ as have also Boisson¹⁸ and others.

Spain and Portugal.—All types occur here, mainly on the coasts and at the mouths of the rivers. Marshall and Thin¹⁹ describe quartan, tertian, æstivo-autumnal, and mixed infections originating in the province of Huelva.

ASIA.

Malaria is practically unknown in the northern regions. In the southern portion the severer forms occur about the eastern end of the Mediterranean and around the Black and Caspian Seas, along the Tigris and Euphrates, and along the coast of the Persian Gulf.

China.—The southern and southwestern coasts are most affected. In Cochin-China (where two-thirds of the country is in rice-fields) and in Tonquin malaria represents from sixty to seventy per cent. of all diseases. Laveran has found organisms in cases sent from Tonquin²⁰ and in specimens from Pekin.⁶

Billet²¹ has studied hæmatozoa in turtles and snakes in Tonquin.

India.—All types are found along the Ganges and Indus, in the jungles and rice-fields, and also in the lowlands along the coasts. Teray, at the foot of the Himalayas, is especially malarious, while in the higher altitudes little or no fever occurs.

The British surgeons in India have done excellent work in malarial parasitology. In recent years Maynard,²² in Calcutta, found organisms in a number of cases examined. McNaught²³ found parasites in 16 out of 20 cases, chiefly "crescents and discs." Later he reports 54 cases observed in Deccan, in 50 of which organisms were found, all but 3 cases (which were tertian) being of the æstivo-autumnal type.

Ross²⁴ reports 112 cases examined during five months, while working on Manson's mosquito theory in Secunderabad. In 69 of these the parasite was found. "There were 2 cases of quartan infection, 21 of spring tertian, 38 summer-autumn, 3 mixed infections, and 5 of doubtful type." He also reports 19 cases in which the

parasite was found by Sturmer, in Madras, out of 41 examined. These 19 were all of the quartan type.

Manson,²⁵ in England, has recently advanced the hypothesis that mosquitoes serve as the alternate host for the malarial organism, the flagellate bodies being the transition form which enables life to be continued in the body of the mosquito, and later in the water or soil. Ross's investigations in India tend to support this theory up to a certain point. Laveran²⁶ and Bignami²⁷ have discussed this hypothesis in recent articles.

Manson has also devised a method of staining the flagellate bodies.²⁵

Rogers²⁸ reports 100 cases from India, in 32 of which he found organisms.

Walsh²⁹ has also found the parasite in many cases in which he examined the blood.

Hehir³⁰ has given much time to the study of the organisms, but his later descriptions are unsatisfactory.

Laveran⁶ has found the same parasites in specimens from Calcutta as seen in Algiers.

OCEANICA.

In the East Indies, Laveran states that six times as many deaths occur from malaria as from cholera.

In Java, Van der Scheer³¹ examined the blood of 105 cases. Tertian and quartan organisms were found in 42 of these, æstivo-autumnal organisms in 63.

Severe types of fever are also met with in Ceylon, Sumatra, Borneo, the Moluccas, and Philippines. Specimens sent from the latter islands by Luna to Laveran showed the usual organisms.⁶

AFRICA.

The severest forms of malaria prevail on the west coast, from Senegambia to the Congo River. In Senegal, one-half to three-fourths of all diseases are malarial. It is in this region that the terrible "blackwater fever" occurs with greatest frequency, and important studies of this condition have been made there during the past few years.

Friedrich Plehn⁴ has observed 438 cases of malarial fever in Cameroon, of which 38 had hæmoglobinuria. He believes he has found a separate variety of parasite in this condition which does not

become pigmented, but which liberates the hæmoglobin from the infected red cells into the plasma. He has noted a distinct tendency to spontaneous recovery in these cases, and claims that quinine is useless, or even dangerous, seeming to precipitate the attacks of hæmoglobinuria, or to aggravate them if already present.

Steudel,³² on the other hand, who has studied this condition in East Africa, believes that quinine in very large doses will cure, while small doses aggravate these attacks.

Fisch⁵ arrives at conclusions similar to those of Plehn. He observed 43 cases of hæmoglobinuria on the Gold Coast from 1890 to 1895. He considers that these cases may be readily distinguished from yellow fever, with which they are frequently confused. He believes the "Schwarzwasserfieber" to be a separate miasmatic disease, due to a distinct organism, but closely related to malaria. His description of the parasite corresponds quite well to that given by Plehn.

Doering³³ treated five cases of blackwater fever in Dahomey with moderate doses of quinine, and all recovered.

Albert Plehn³⁵ has studied 411 cases of "tropical" malarial fever in Cameroon. Forty-three of these were cases of blackwater fever.

He considers it possible that malarial hæmoglobinuria may be caused by a separate type of organism, although he could detect no morphological difference between the parasites which he found in these cases and those occurring in the ordinary tropical fever of the æstivo-autumnal type. He saw only one case of benign tertian fever in his eighteen months' experience in Cameroon, and this occurred in a European who was living in the Cameroon mountains. This case showed the characteristic tertian organisms.

He comes to the following conclusions in regard to the hæmoglobinuria:

1. Quinine is superfluous, because the organisms which it combats are rapidly destroyed in the blood as a result of their own activity.

2. Quinine is dangerous in the highest degree, for it seems especially liable in these cases to cause renewed blood-disintegration.

3. A number of attacks of ordinary tropical fever predispose to the blackwater fever.

4. The same predisposition is induced by long uninterrupted residence in these regions without previous malarial attacks.

Bacelli,^{17b} in Italy, has studied this subject, and believes that the disintegration of the hæmoglobin in blackwater fever is not due

to the parasite itself, but to its toxic products. He distinguishes four classes of hæmoglobinuria :

1. Pernicious malaria with hæmoglobinuria cured by quinine.
2. Mild attacks of malaria accompanied by hæmoglobinuria only when quinine is given.
3. Hæmoglobinuria coming on in persons who have had malaria some time before, and not associated with quinine.
4. Hæmoglobinuria produced by small doses of quinine in persons who have had malaria previously.

Manson²⁵ considers the peculiar geographical distribution of this form of malarial fever (it being found mainly in certain well-defined regions of Africa and Greece, occasionally in Italy, America, and the West Indies, but only rarely in India and China), together with the fact of its recurrence in patients after their return to colder climates, to indicate an infection with a separate variety of parasite.

Antony³⁶ reports a case of "fièvre bilieuse hæmaturique" from the Soudan, in which crescents and flagellate bodies were found in enormous numbers.

Carmouze³⁷ has also studied this condition in the Soudan.

The reports on the parasite and on the treatment of malarial hæmoglobinuria in Africa are therefore conflicting, and the whole subject requires further elucidation.*

Ziemann³⁴ found the tertian parasite in 14 cases of benign intermittent fever in Cameroon. *Æstivo-autumnal* organisms were found in 85 cases of tropical fever. He believes the latter parasite can cause quartan paroxysms.

Marchaux³⁸ found Laveran's parasite (hyaline and crescentic forms chiefly) constantly in 347 cases of tropical malaria in Senegal.

Moore³⁹ has found *æstivo-autumnal* organisms in Ashanti fever.

Duggan⁴⁰ reports 400 cases from Sierra Leone in which the *æstivo-autumnal* parasite was found. The tertian organism was seen but once, in a patient who had suffered from malaria in the East Indies two years previously. No quartan forms were found.

From the above reports from West Africa, both tertian and quartan infections would seem to be rare in that region.

Eastern Africa.—In Zanzibar, at the mouth of the Zambezi, and in Madagascar all forms of fever occur in great severity.

* Yersin and Breaudat claim to have found a *cocco-bacillus* as the cause of "fièvre bilieuse hæmaturique." (See *Archiv. de Med. Navale* for July, 1895; and also vol. lxx., 1896, p. 457.)

Laveran³⁰ has found his organisms in cases coming from these regions.

Boisson⁴² found the parasites in Madagascar in every case when the blood was examined at the paroxysms.

The islands of Mauritius and Reunion, once exempt from malaria, have been infested with malignant types since 1867. In 1893 Laveran⁶ found organisms in specimens sent from these islands, thus establishing the nature of the much-discussed fevers prevailing there.

In Abyssinia, Nubia, and Egypt malaria is found in the lowlands and along the river-banks. These diseases were known to the ancients, as shown by inscriptions in Egypt.

The Suez Canal is a fertile source of malaria.

Kaufmann⁴³ found tertian, quartan, and æstivo-autumnal parasites in Egypt.

In *Algiers*, Laveran made his first studies of the parasite. Malaria prevails on the coast and along the rivers, but less now than formerly, owing to drainage. Quotidian intermittent fever is the most common form; quartan is rare.

In *Tunis*, *Morocco*, and *Tripoli* fairly frequent infections occur, but of a mild type.

Central Africa.—Malaria is apparently less severe here than along the coasts, but was found to exist along the rivers and lakes by Livingstone, Stanley, and Barth.

Smith⁴⁴ has recently given an account of the fevers observed by him during explorations. No study of the blood could be made, but he noticed that there was a "close connection between fairly rapid alteration of level (in either direction) and the determination of the malarial attacks."

SOUTH AMERICA.

Severe infections occur on the east coast, especially the Guianas, Venezuela (where Dominici⁴⁵ has found Laveran's organisms), Colombia, the Orinoco basin, and Brazil. In *Guatemala* very severe forms occur everywhere, and Echeverria⁴⁶ has found the parasites in a large number of cases originating here.

In *British Guiana*, Daniels⁴⁷ has found organisms, as has also Ozzard,⁴⁷ who reports that the majority of cases here are of the tertian form, both mild and malignant. The latter type of infection exists all the year round in this country, so that the term "æstivo-autumnal" does not apply here.

In *Brazil*, Fajardo⁴⁸ has studied the parasite and sent specimens to Laveran, who identified his "hæmatozaire."

In *Peru* and *Bolivia*, on the west coast, malarial fever is less frequent, but all forms apparently occur. Leon's⁴⁹ account was not accessible to us.

In *Argentine Republic*, fevers are found in the lowlands, and the organisms have been studied.⁵⁰ Malaria is rare in Montevideo and Buenos Ayres, and is almost unknown below 30° S. latitude.

CENTRAL AMERICA, CUBA, AND MEXICO.

The severest forms—"Chagres" or "Panama fever"—prevail in the lowlands along the coasts, while on the plateaus little or no malaria is found. *Æstivo-autumnal* organisms have been frequently found in patients coming to the United States from Panama and neighboring regions.

In the *Antilles*—Cuba, Guadeloupe, Martinique—much fever is found. In Cuba Coronado⁵¹ believes he has succeeded in cultivating the organism in an "artificial swamp." As yet his experiments lack confirmation. He also claims to have found organisms corresponding to Laveran's hæmatozaire in "soil, air, and water."

In *Mexico*, Matienzo⁵² found hæmatozoa in all cases examined in Tampico in 1892.

NORTH AMERICA.

The severer forms of malaria are found on the Atlantic coast south of Virginia, in the Gulf States, and in the great central plain along the Mississippi and its tributaries.

All three varieties of the parasite are found in these regions. Of 616 cases reported in Baltimore by Thayer and Hewetson,³ 544 showed organisms whose type was distinctly recognized. Of these, 338 were tertian, 5 quartan, 188 *æstivo-autumnal*, and 11 mixed infections.

In the District of Columbia, French⁵³ found organisms in 94 out of 105 cases; 49 of the 94 were *æstivo-autumnal*, 40 tertian, 3 combined infections. In 2 cases the *æstivo-autumnal* parasite occurred in phthisis patients.*

French has also reported a case of coma in an infection with the ordinary tertian organism.

A number of cases of malarial hæmoglobinuria have been re-

* See also Rust's case.¹⁰

ported from the Southern States during the past three years.⁵⁴ This condition is described as being fairly frequent in late summer and autumn in certain parts of North Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas, and Indian Territory. Many of these observers have arrived at Plehn's conclusion, that quinine in this condition is not only ineffectual but actually harmful.

Woldert,⁵⁴ of Tyler, Texas, has found æstivo-autumnal organisms in two cases of hæmoglobinuria. His is the only report found in which the blood was examined. Certainly, the occurrence of this serious condition in such a wide region offers excellent opportunities for the solution of the problems which it presents.

In North Carolina, Whitehead⁵⁵ reports four cases resembling typhoid fever in which the blood was examined and organisms found belonging to the æstivo-autumnal type.

North of the 40th parallel mild forms are found along the Atlantic coast, about the Great Lakes, and on the Pacific coast, especially in the valley of the Sacramento. Occasional severe forms, apparently endemic, are also met with in these regions.

In Chicago, Whiting⁵⁶ has studied the organisms in cases of tertian, quartan, and æstivo-autumnal fever. The quartan infection was imported, the others originated in Chicago. The chart of the æstivo-autumnal fever shows characteristic "æstival-tertian paroxysms" as described by Marchiafava and Bignami.⁵⁷

Burleigh⁵⁸ describes a case of æstivo-autumnal fever originating in Michigan. This temperature-chart also shows typical "æstival-tertian" paroxysms. In the blood of this case the outermost zone of the crescents presenting a double contour showed a staining with eosin—indicating that the apparent "capsule" is a remnant of the enclosing red cell.

Prebble⁵⁹ reports the finding of tertian organisms in about 150 cases of malarial infection, with a few cases in which the æstivo-autumnal parasite was seen. The latter were nearly all imported.

In Philadelphia, Leonard⁶⁰ gives serial photomicrographs of a tertian segmenting body.

In Boston, Jackson⁶¹ describes 4 cases in which the organisms were identified; 2 tertian and 2 æstivo-autumnal. A case of congenital malaria is reported by Winslow⁶¹ in which plasmodia were found. The mother of this child had had quotidian malaria for two weeks before delivery.

In New York, Winfield⁶² has reported several cases of zoster, apparently of malarial origin, in four of which organisms were found.

Craig⁶³ reports the finding of tertian and æstivo-autumnal parasites in cases in Brooklyn.

Sheffield⁶⁴ has recently recorded 16 cases of malarial fever in children, in all of which the parasite was found, being apparently of the tertian type, except in one case, where crescents were seen. Thirteen of these 16 cases certainly originated in New York City.

The field of malarial parasitology is therefore wide and varied in our own country, but the laborers are thus far few. It is on this account that we present here our gleanings, trusting that further reports from this and other regions may speedily advance our knowledge of this disease.

THE MALARIAL FEVERS OF NEW YORK CITY.

The idea has long existed among practitioners in this city that the malarial diseases of Manhattan Island present certain peculiar clinical and pathological features, differing from those manifested in other regions. The type of fever here is said to be often markedly irregular, and it is asserted that the organisms found so constantly in these infections all over the world, are frequently altogether absent in the cases occurring here. Tradition has it also that Manhattan malaria is peculiarly resistant to the action of quinine when given alone. Judging from the returns received by the local Board of Health, moreover, malaria in this region would appear to be a fearful scourge. Osler⁶⁵ has published some remarkable statistics derived from the health boards of several of our large cities, to which he refers in his article on Malaria in Albutt's "System of Medicine," in part as follows: "In the United States Census Reports for 1890, which cover the six preceding years, the deaths from malarial fever in New York and Brooklyn were more numerous than from typhoid fever" (amounting to nearly 3,500 in all). This appalling mortality led him to treat the subject of malaria in an address⁶⁵ before the County Medical Society of New York, under the following heads:

- "1. The diagnosis of the regular malarial intermittent fevers.
2. The diagnosis of the irregular remittent and pernicious forms.
3. The spurious malaria of the Health Boards."

In this article we hope to show, so far as our experience goes,

what differences, if any, the malarial fevers of New York present as compared with the same types of fever observed elsewhere.

1 MALARIA IN NEW YORK CITY IN 1897.

A rather unusual number of cases of malarial fever occurred in New York during the past year. The extensive excavations in the streets of the city may account to some extent for this increase. Such tearing up of the streets has frequently been held responsible for an unusual prevalence of this disease. Thus Loomis, in his "Practical Medicine" says: "In New York City, while the Fourth Avenue improvements were being made, the entire region along the avenue was rendered highly malarious by the excavations." As we have no knowledge as yet of the life-history of the malarial organism previous to its appearance in the blood, this inference lacks positive proof.

During the six months from May to November, 1897, there were treated at the Presbyterian Hospital 87 cases of malarial fever in which the characteristic organism was found. Of these cases, 31 were seen in the Out-Patient Department, and 56 were treated in the hospital wards. Of the latter number, 31 cases occurring in the wards between June 16 and October 1 were studied with especial care, and systematic examinations of the blood were made at definite periods during the attacks.

Of the remaining 25 cases observed in the wards, organisms were found in all, and the type of disease to which each case corresponded was determined, but the examinations were not carried out in detail as in the other 31 cases.

In the thirty-one dispensary cases the blood also showed the presence of the parasites, and the special type of infection could be distinguished in each. The histories of these cases, however, are very imperfect, and any systematic course of blood-examination was impossible.

The methods followed have been in general those adopted by Thayer and Hewetson.³

The examination of the fresh blood has been found so much more satisfactory than the study of stained films, that the latter have been employed simply to supplement evidence already furnished by the fresh specimens.

The ear has been found the most convenient situation for obtaining the blood. By pinching the lobe between the thumb and fore-finger, the quick stab of the needle at the blanched margin is scarcely felt, and the size of the resulting drop may be regulated by gentle manipulation.

The thin cover-glasses were prepared by immersing for some hours in strong nitric acid, then kept in alcohol until used. The slides were cleaned with alcohol and ether, equal parts. Both cover and slide were polished with a clean, dry cloth before using, and the last speck of lint or dust was blown off just before taking up the blood.

The skin having been cleansed with alcohol, a small drop of blood was drawn, and the cover-glass, held lightly between a thumb and finger placed at opposite edges, was brought in contact with the summit of the drop. The cover being then placed at once on the clean slide, the blood spread out under it in a thin, even film. Tapping or pressing on the cover-glass distorts and breaks up the red cells.

The fixing and staining methods used for permanent specimens were those recommended by Thayer and Hewetson, *viz.*, hardening the cover-glass spreads for half an hour in equal parts of ether and absolute alcohol, then staining with one-half per cent. eosin solution in sixty per cent. alcohol for a few seconds, washing with water, and then staining with concentrated aqueous solution of methylene blue for about half a minute. The specimen is then washed quickly in water, dried, and mounted in balsam.

GENERAL ANALYSIS OF THE EIGHTY-SEVEN CASES.

In presenting the clinical aspect of malarial fever as seen in New York City, it is fair to assume that the cases seen and examined in the Presbyterian Hospital form a fair average of all the cases that may be met with on Manhattan Island, in so far as it is possible to draw conclusions from so limited a number.

The patients have come from all parts of New York City and the surrounding country, besides a number who evidently contracted the fever at a distance. This number, eighty-seven, includes only those cases in which the malarial organism was found in the blood and whose development was studied in its various stages. There

were also a fair number of cases in both the wards and Out-Patient Department which were evidently malarial fever, both from the history of the cases and so far as physical examination went, but who had either taken quinine before they were examined or who were undergoing a spontaneous cure, so that no organisms appeared in the blood. These are left entirely out of account. The following is the classification of the cases by months compared with the corresponding months of 1896 :

		May.	June.	July.	August.	Sept.	Oct.
1897.	{ Ward Cases	5	13	16	8	12	2
	{ Out Patients	0	8	18	5	0	0
1896.	Ward Cases	1	3	10	15	15	10

Two seasons could hardly be found which showed the contrast of temperature that the summers of 1896 and 1897 did, notably the month of August, which, in 1896, was by far the hottest month for many years, while the corresponding month in 1897 was one of the coolest on record. September in the two years also presents a fairly wide range of difference in the same direction, only not so marked. Although the average of temperature during October in the two years did not show a great difference, the number of cases for the two months did.

It will be seen, therefore, from the foregoing classification that the vigor of the organism seems to bear a direct relation to the height of the temperature ; and the fact that there were five times the number of cases in October, 1896, compared with the corresponding month in 1897, was undoubtedly due to the previous heat and the consequent probable increase in number and virulence of the organisms—although the types were much the same, there being only two cases of the severer form of malaria, *æstivo-autumnal*, in each year.

CLASSIFICATION OF THE FIFTY-SIX WARD CASES.

Age.—The age of the patients ranged from three to sixty years, the average being thirty-one years.

Sex.—Males, 30 ; females, 26.

Color.—All the patients were white, and of almost all the nationalities to be found in New York.

Of these 56 cases there were :

Primary attacks.....	32
Relapses or new infections.....	21
Uncertain.....	0
Relapses in cases returning to the hospital for treatment.....	3
	56

TYPES.

Of the types of the cases it is interesting to note that they were with two exceptions all of the tertian variety, either single or double ; there being no quartan fevers, and only two æstivo-autumnal infections.

Tertian.....	{	Single.....	33
		Double (Quotidian) { Regular.....	16
		Irregular.....	5
Quartan.....			0
Æstivo-autumnal			2

Compare this classification with that of Thayer and Hewetson in their article on the " Malarial Fevers of Baltimore," of 542 cases.

<i>First Half Year.</i>			<i>Second Half Year.</i>		
Tertian {	ingle	63	Tertian {	Single	87
	Double	49		Double	139
Quartan {	Single	1	Quartan {	Single	1
	Double	0		Double	0
	Triple	0		Triple	3
Æstivo-autumnal		5	Æstivo-autumnal		183
Combined		3	Combined.....		8
		121			421

In this there are two things of interest to be noted :

First. The fact that in Baltimore, during the second half year, there were 183 cases of æstivo-autumnal infection against 230 of tertian and quartan fevers combined—showing the greater prevalence of the more severe type of malaria (æstivo-autumnal) the farther South one goes. This truth is also apparent in studying malaria about the Gulf of Mexico, or even farther south in Central America.

Second. That it is during the hotter part of the year, the second half, and particularly the latter part of the summer and early fall, that the more severe type prevails.

Observations upon the increased severity of malaria in New York as the season advanced will be made under treatment.

With five exceptions the tertian fevers were the typical single or double infections which are to be met with in almost any locality, and showed nothing new or exceptional. The reader is referred to any of the more recent articles on malaria by authorities^{7, 66} for a general view of the subject. The five exceptions referred to were what made up a group of irregular tertian fevers. In all these cases there was an infection with two or more distinct sets of organisms, and a few of the patients had taken irregular doses of quinine from time to time, so apparently modifying the infection without destroying the organisms, but only changing their cycle of development. This subject will be dealt with more fully under the general head of parasitology.

As has been said, there were no quartan fevers; and in looking over the hospital records for the past nine years, there are only two cases reported—both doubtful, in that no organisms were found in either, and the symptoms and physical signs were not convincing. Hence, it may be stated, as indicated by this present investigation and by past records, that quartan malarial fever is of very rare occurrence in this locality; so rare, in fact, that it need only be kept in mind as a possibility.

The *æstivo-autumnal* fever is also comparatively rare in this climate, but cases do occur, both by importation from the South, as is shown by previous hospital records, and so far as we can judge, spontaneously on the island—for neither of our cases of this type had been out of the city for some time previous to admission, one for five years and the other for seven months. So it is fair to assume that their infection originated here. The organism of this type is so vigorous when it gets into the system, that it would be natural to infer that it would be so outside the body, and that it would therefore be more prevalent—however, it is evidently less resistant to its environment, especially cold, as it is only in warmer climates that it becomes at all frequent.

There is nothing of importance from a clinical point of view in our cases of *æstivo-autumnal* fever that cannot be found in any good article of recent date. That they are almost always irregular in their symptoms and course is their striking feature. So one must always be on the lookout for them when an irregular fever remains

unexplained, and often nothing short of an examination of the blood will give any clew to their malarial origin. This was noticeably so in one of these cases, where diagnoses ranging from endocarditis to sub-diaphragmatic abscess were made until the question was settled by the microscope. It is to be kept in mind also that these two cases occurred in September and October, and not early in the summer.

DISTRIBUTION OF CASES AS TO ORIGIN OF INFECTION.

In studying the distribution of cases it will be seen that contrary to a long-established belief on the part of many, malarial fever can and does originate on Manhattan Island.

In taking the histories of the cases, special reference was paid to ascertaining as accurately as possible the locality to which the infection could be traced by asking :

1. Whether patients had ever had malaria before or not.
2. Whether the attack for which they came for treatment originated on the island, and when they were out of the city last.
3. If their present attack did originate on the island, on what part of it.
4. Or if in the immediate vicinity, where.
5. Whether it was imported from some considerable distance.

Attention was also paid to ascertaining if possible what part the torn up condition of the streets played in the distribution of cases. Of the 5 patients who traced their infection to open streets, only 2 of them were laborers in the work, and as they are by far more exposed than anyone else, it is surprising that there were not more cases. Possibly this argues that open streets are not so unhealthful as has always been supposed, at least so far as infection by the malarial organism is concerned.

According to inoculation experiments by Celli, Mariotti, Antolisei, and Angelini (quoted by Thayer and Hewetson),³ who put the average time of incubation for the tertian parasite from eleven to twelve days, and from the few accurate observations we have been able to make where the day of infection seemed evident (the average being fourteen days), it has been thought fair to assume that all cases of primary malaria appearing in patients who had not been off

the island for one month, originated in the city. Hence the following table, which practically explains itself :

Primary Attacks..	{	Originating on Manhattan Isl- and. (Patients not out of the city for at least one month previous to attack.)	{	East side	11
				West side	1
				Central Park	0
				Locality of open streets.	5
				Uncertain	1
					18
	{	Originating apparently in New Jersey		2	
		“ “ on Long Island		6	
		“ “ in Westchester County.		2	
		“ “ in distant places		9	
					19
Relapses or New Infections	{	Originating on Manhattan Isl- and. (Patients not out of city for one month, etc.)	{	East side	3
				West side	1
				Central Park	1
				Locality of open streets.	0
				Uncertain	1
					6
	{	Originating apparently in New Jersey		4	
		“ “ on Long Island		3	
		“ “ in Westchester County.		4	
		“ “ in distant places		7	
					18

The locality of the infection was thus traced in 61 of our 87 cases, and of these, 18 cases certainly, and probably 6 cases besides, originated on Manhattan Island.

One thing only need be said to make the apparent immunity of the west side of the city clear. The Presbyterian Hospital is situated on the east side, hence the greater number of patients from that locality, while reports from hospitals on the west side and from physicians located there confirm the opinion that there is very little difference in the two sides of the city in respect to the number of cases to be found.

Along with dispelling the belief that malaria cannot originate on the island, another time-honored theory has to be given up, *viz.*, that malarial cases here often show no organisms in the blood. True malaria in New York, like the disease in all other localities, shows organisms in the blood, and in every case reported, the typical parasite was found in one form or other, as will be described later.

The question is often raised—does chronic malarial poisoning exist in this region? Undoubtedly, cases are occasionally seen, but probably are imported from warmer climates; however, our observations are confined to too limited a number to be of any value on that point.

SYMPTOMATOLOGY.

1.—*Subjective Symptoms.*

The usual symptoms of malaria are almost too well known even by the laity to need repetition, and yet since we are dealing with malaria as met with in New York City, a short résumé of some of the more important ones is necessary, and there are several points in this connection well worth studying.

Chills. In these 56 cases there were in the hospital:

Distinct rigor in.....	46
Chilly sensations in.....	9
Neither in.....	1 (æstivo-autumnal).
There was a paroxysm of chill, fever, and sweating in.....	46
Headache in	36
Backache in	8

No accurate account of the cases which had *vomiting* was kept, but it was a very frequent symptom. The average length of the paroxysm was sixteen hours, rather longer than that given by most observers in other localities, who put the average as twelve hours.

2.—*Objective Symptoms.*

Spleen.—The most familiar of these symptoms is, of course, the almost invariable enlargement of the spleen. This is by far the most characteristic symptom of this class, and it has seemed worth while to study it with special reference to several features which will be found in the following table:

I. Cases in which spleen was enlarged by palpation or percussion..	51
II. Cases in which spleen was not enlarged by palpation or percussion	5
III. Average day of disease on which enlargement was noted.....	7th day
IV. Average day of disease on which spleen disappeared after last chill (the extremes noted were second to thirteenth day).....	6th day
V. Cases which had tender spleens	8

A word only in regard to III. and IV. The extremes, earliest and latest day on which enlargement was noted, were the second to twenty-first day, but the majority of cases of malaria seldom come to the hospital for treatment earlier than the end of the first week. They do not feel ill enough to give up work, and as the second day is usually not marked by a chill and they feel generally better, put off seeing a physician until after the second or third chill, and even then many of them temporize still longer, until the accumulated infection becomes so strong that they are no longer able to keep about.

The fact that 8 of the cases applied for admission early in the course of the disease—2 on the second day and 6 on the third—all with spleens readily palpable, suggests the almost certainty that the majority of cases have spleens easily recognized as enlarged by the third day at least. This is rather interesting, too, as a point of differential diagnosis between New York malaria and typhoid seen in the first few days of the disease. As we know, the spleen is seldom large enough in the latter to be recognized before the fourth or fifth day, and often not until later.

The day of disappearance of the spleen after the last chill was not altogether satisfactorily determined, because many of the patients left the hospital with the spleen still enlarged, so the statistics on this point were gathered from only ten cases, a very limited number.

Liver.—The accompanying enlargement of the liver in malaria is also well known, but is more rare in New York than farther south, because the disease is not so severe here as a rule.

There were 17 cases with enlarged liver, and 3 of these were also distinctly tender; so much so in one case that, taken in connection with the presence of a few scattered râles over the hepatic area and a slight icteric hue to skin and conjunctiva, a diagnosis of possible abscess of the liver was made, although a blood-count failed to show any considerable leucocytosis. The temperature curve also closely resembled that seen in cases with septic infection. An examination of the blood, however, cleared up the diagnosis, as typical forms of the æstivo-autumnal organism were found.

Herpes.—Herpes of lips, face, or trunk occurred in 10 cases; that is, in nearly one-fifth of all the ward cases, showing it to be a very frequent symptom and of value in differential diagnosis.

COMPLICATIONS.

A list of complications seen in these cases is appended, although considered of little value except when taken in connection with the statistics given by other writers as showing that practically no other disease precludes the added infection with the malarial organism.

- | | | |
|-------------------------|----------------------------|--------------------------|
| 1. Acute delirium. | 4. Cirrhosis of liver. | 7. Paranoia. |
| 2. Urticaria. | 5. Pleurisy with effusion. | 8. Chronic endocarditis. |
| 3. Peripheral neuritis. | 6. Acute gastritis. | 9. Acute keratitis. |

One case gives the history of relapsing malaria, and with every attack had an acute keratitis, which, the last time, resulted in corneal ulceration.

RELAPSES.

In this series of 56 there were 24 cases of relapse or new infection. Of course it is difficult, and, in fact, impossible, to decide in all cases whether the attack is a true relapse from the original infection (in which, although the organisms may have disappeared from the peripheral circulation, they still exist in the internal organs and bone-marrow), or whether it is an actual new infection from without. Of these 24 cases there were 5 which were in all probability true relapses, for between actual attacks none of them were entirely free from symptoms of malaria, but had irregular chills, frequent headache, and malaise. The remaining 19, so far as our present knowledge of the subject goes, were new infections, although, of course, we cannot be sure the organisms had not remained in a quiescent state in some of the internal organs. For all practical clinical purposes, however, they may be dealt with as new infections, because there were no continuing or intermittent symptoms between attacks.

Of the *true relapses*—5 cases—we have the following classification. The extremes of time between attacks ranged from sixteen days to five months :

1 case relapsed at 14 days	} Average time, nine weeks.
1 " " " 11 weeks	
2 cases " " 12 "	
1 case " " 5 months	

Of the *new infections*—19 cases—extremes of time between attacks, two months to six years :

1 case reinfected at	2 months	} Average time, thirteen months.
1 " " "	3 "	
1 " " "	4½ "	
1 " " "	9 "	
1 " " "	10 "	
5 cases " "	12 "	
2 " " "	2 years	
1 case " "	4 "	
1 " " "	5 "	
2 cases " "	6 "	
3 " " "	unknown interval	

PARASITOLOGY.

THE ORGANISM OF TERTIAN MALARIAL FEVER.

Time After Beginning of Chill.	1 hour.	2 hours.	4 hours.	6 hours.	8 hours.	12 hours.	16 hours.	18 hours.	20 hours.	22 hours.	24 hours.	26 hours.	28 hours.	30 hours.	32 hours.	34 hours.	37 hours.	38 hours.	40 hours.	42 hours.	44 hours.	46 hours.	47 hours.	At or just before Chill.	Totals.	
Number of Examinations Made.	8	7	11	6	5	1	2	3	5	8	19	4	7	3	3	2	1	1	2	3	1	3	8	21	134	
Hyaline bodies	4	4	4	2	1																			1	16	
Very young pigmented bodies				2	2		2	1																	1	50
Half-grown bodies	1								2	4	18	4	7	2										2	74	
Nearly mature bodies															3	2	1									8
Mature bodies	7	7	11	5	5	1			1		1		1					1						6	7	
Segmenting bodies	5	1	1																2				1	2	17	
Flagellate bodies			2						2														1	1	7	

The above table shows the results of blood-examinations made in 36 cases at definite times in relation to the beginning of the paroxysm.

The tertian organism was thus studied every two hours, approximately, in the course of its life-history.

Of these 36 cases, 27 were ward patients, while 9 were dispensary cases in which the time of beginning of the previous chill could be definitely ascertained.

In 20 of these 36 cases a single group of organisms was present, all maturing at the same time, and therefore causing "tertian" paroxysms. In 16 cases organisms at two different stages of development

could be demonstrated. These were examples of "double tertian infection," giving rise to a quotidian intermittent fever. In two instances of double infection the organisms of one group were so few in number that they caused no elevation of temperature.

There are entered in the table 134 examinations of these sets of organisms, representing specimens taken at different periods in the development of the various groups. Where two distinct groups of organisms were present in the same specimen, the forms belonging to each group are entered separately, the time of entry for each form referring to the paroxysm at which it was born. Deducting 26 specimens, each of which was thus entered at two different hours, there remain 108 separate blood-examinations on which the table is based.

It will be seen that the greater number of examinations were made at the beginning, at the middle, and at the end of the forty-eight-hour cycle. The reason for this was partly because the greatest amount of information could be obtained at those times, and partly because the two intermediate periods usually came at night, since most of the paroxysms occurred during the daytime. The intermediate examinations, however, afforded sufficient information to determine the state of development of the parasite at practically all periods of its existence in the blood.

The table shows that hyaline bodies were found during the first eight hours after the beginning of the chill; the earliest pigmented forms appeared during the next eight hours; the half-grown bodies were present during about twelve hours at middle life; nearly mature forms developed during about eight hours between the thirtieth and fortieth hours after the chill; while the full-grown bodies were observed during the eight hours before the chill, and for eight hours or more after it.

The life-cycle of the parasite may therefore be divided roughly into six periods of about eight hours each, corresponding to quite definite stages in the development of the organism—middle age occupying the greater part of the third and fourth of these periods, while adult forms occur throughout the first and last.

Certain circumstances seem to modify the regularity of this development, and it is interesting to note the conditions obtaining in the scattering entries in the table which do not fall within these periods. The single case in which very young pigmented forms

were found at twenty-two hours, was a double tertian infection with irregular temperature, in which quinine had been taken before entrance to the hospital. Half-grown bodies and large extracellular fragmenting forms were found in the same specimen, so that the usual regular grouping was not present.

Of the five cases in which half-grown bodies were found out of season, two had had quinine twenty-four hours or more before the examination was made, two were cases in which the infection was dying out spontaneously, while the fifth was a case which had no well-defined paroxysms, but an irregular daily rise of temperature.

Of the nearly mature bodies noted, the case entered at thirty hours was an anticipating tertian, so that the forms observed were two hours ahead of schedule time; the case entered at thirty-seven hours anticipated about four hours at each paroxysm, so the forms there seen might have been expected that much later.

Of the three cases in which mature bodies were found at the middle periods, one had had quinine twenty hours before, one was a case of double infection with only tertian chills, while the third had no distinct paroxysms, but an irregular daily fever.

Forms are therefore found at stages of development which do not correspond to the period at which they are observed in the paroxysmal cycle :

a. When quinine has been administered or the infection is dying out spontaneously.

b. When a second group of organisms is present in insufficient numbers to cause a febrile disturbance.

c. When several different generations of organisms are present in the blood at the same time, causing an irregular temperature.

d. When the paroxysms are anticipating or postponing.

The large adult forms may doubtless remain in the circulation for many hours after arriving at maturity, and half-grown bodies which burst from the corpuscles may apparently become swollen in the plasma nearly to adult size. Certainly, quite large extracellular bodies may be found even in the single tertian infections at almost all periods of the cycle.

Segmenting bodies were found from two hours before to four hours after the beginning of the paroxysm, the greatest number occurring just before or at the time of the chill.

Flagellate bodies were found in 5 specimens at the time of the

paroxysm, and in two instances during apyrexia twenty hours after the chill.

The different forms have been designated as "hyaline," "very young pigmented," "half-grown," "nearly mature," and "mature," according to the stage of development.

The Hyaline Bodies.

These are the earliest intracellular forms seen in the blood. They are found in company with the full-grown and segmenting bodies belonging to the same group of organisms, and occur at all times during the first eight hours after the beginning of the paroxysm. Their presence indicates that the paroxysm has begun, and they are found in greatest numbers when the temperature reaches its highest point, or soon afterward.

In appearance the hyaline body is a pale disc, when at rest, of a diameter from about one-sixth to one-fourth that of the enclosing red cell. It exhibits a darker central area which corresponds in situation to the highly refractive nuclear point in the divisions of a segmenting body, but is less sharply defined and larger. As pointed out by Marchiafava and Celli in 1885,⁶⁷ the hyaline body apparently consists of a thicker outer zone and a central thinner area. The darker shading at the centre of the body would therefore seem to be due to the greater thickness of the layers of red cell covering this thinner portion.

In the tertian parasite the outline of the hyaline body is not sharply defined, the thick outer zone apparently becoming thinner at its border, and fading gradually into the substance of the red cell.

When in active motion—a state which lends to the hyaline body an absolutely diagnostic significance—the outline of the body shows an undulatory movement, while from time to time pseudopodia are thrust out at one or more points from the thicker outer zone. The darker central spot persists throughout these changes of form. When the pseudopodia are given off from only one side of the body, this dark spot lies nearer the opposite margin.

Sometimes two hyaline bodies may be seen inhabiting the same red cell.

As the specimen grows older, an hour or more after being taken, the active movements of the hyaline body cease, and its outline be-

comes more sharply defined. At the same time a clear space seems to form about the central darker area, giving the body as a whole a "ring-shaped" appearance. (In one instance a hyaline form at this stage was seen to burst from the red cell, just as the larger pigmented forms are often seen to do, the corpuscle at once becoming decolorized.) The dark central spot enclosed by the clear ring-shaped space now becomes crowded to one side, and finally meets the thin outermost zone of the body, leaving a sharply outlined crescentic clear space occupying the central portion of the organism. This space presents a shining appearance.*

Still later, this central crescentic space may often be seen to expand, the darker surrounding zone of the hyaline body becoming correspondingly narrower until it is no longer distinguishable from the substance of the enclosing red cell. The red cell then appears to contain only a sharply outlined, colorless crescentic vacuole.

These changes in the hyaline body have appeared to us to be degenerative, and resemble very closely the changes observed in the separate spores of a segmenting body an hour or more after the specimen has been prepared. A similar process also occurs in the formation of the vacuoles in large degenerating pigmented forms. It should be stated here, however, that this central clear space is regarded by Mannaberg² as representing the nucleus, the darker spot being the nucleolus. The fact that this appearance was seen in both hyaline bodies and spores only when the specimen was an hour or more old, after retrograde changes had begun in the blood, and also that a similar appearance occurs during vacuolation in the adult forms, led us to believe that this process might be degenerative.

The Very Young Pigmented Bodies.

At about eight hours after the chill, sometimes an hour or two earlier, pigment granules begin to form in the hyaline bodies, appearing as one or more very fine reddish-brown specks in the outer zone. When pseudopodia are given off from this zone, the pigment granules are often carried with them.

The central darker area may still be made out at this time, and remains uninvaded by pigment as long as it persists.

The granules of pigment are at first so fine as to be just visible

* See plate, I, group 1.

with a one-twelfth immersion lens, and exhibit only a slight oscillatory motion. Later on they become coarser and show the characteristic lively "dancing" movement.

At about sixteen hours after the chill the appearance of the organism has changed somewhat. The pigment granules are more numerous and coarser than before, and are now scattered throughout the body, the central dark spot being no longer distinguishable. The body is a little larger than at eight hours, and more actively amœboid. The wavy outline of the rounded forms is often so ill-defined that the organism could hardly be distinguished were it not for the dancing pigment. The pseudopodia are much longer than before and present clubbed ends in which are small collections of pigment granules. These ends are often quite round and separated from the main body by fine strands of protoplasm which may be entirely invisible, their position perhaps being only indicated by a granule or two of pigment.

The Half-grown Bodies.

For about twelve hours at the middle of its life-cycle the parasite presents its most actively amœboid state.

It is larger than the very young forms, occupying perhaps a third of the red cell, and contains more and slightly coarser pigment granules.

The rounded form with faint undulatory outline may be seen—but the characteristic appearances are presented by the numerous pseudopodia with their constantly changing shapes.

Sometimes two or three clubbed projections will be given off from either side of a longitudinal axis, or they will arise more irregularly from various points at the periphery of the organism. Frequently the whole body will divide into three, four, or five rounded portions separated by slender filaments which may be quite invisible. In this case the red cell appears to be occupied by several separate organisms, each with its content of dancing pigment. Occasionally one of these forms will burst forth from the red cell. It is then seen to consist of a series of pigmented masses connected by delicate threads of protoplasm in which a single pigment granule may here and there be caught. Motion in these escaped bodies may at once cease, or continue for a short time, the pigment dancing more and more slowly, and the connecting strands perhaps

waving a little from side to side. Only the colorless, shadowy outline of the red cell from which it has burst remains in the field.

When the bodies with clubbed pseudopodia escape in this way, they may continue to show a languid amœboid movement in the plasma for some little time.

The half-grown body frequently assumes an elongated form, perhaps bulging here and there, or with one or both extremities clubbed. It may then present a partially coiled appearance, or the ends may meet and form a true ring, enclosing a bit of the red cell. The same body may change rapidly from one to another of these forms. The enclosing red cell is at this stage distinctly larger and paler than the normal ones.

The Nearly Mature Bodies.

After about the thirty-second hour of its life-history the tertian parasite approaches maturity. Its appearance now is in general different from that of the half-grown forms.

It is larger, occupying about one-half the red cell, and although it still shows amœboid movements, and the pigment is lively as ever, its quarters in the red cell are so cramped that such extensive excursions as before are no longer possible. It lies at or near the centre of the corpuscle, its form usually rounded with a wavy outline, while the pigment now shows a tendency to collect about the periphery.

Pseudopodia, when exhibited, are short and thick, a single projection often containing half the substance of the organism. No division into separate portions connected by slender strands is seen—although there may be a grouping of three or more rounded bunches of confluent protoplasm.

The Mature Bodies.

During the eight hours before the paroxysm the organism appears at its full growth. It now almost or quite fills the corpuscle, which is swollen to a considerably larger size than normal. The pale surrounding rim of red cell narrows to a mere outline and then disappears, leaving the parasite free in the plasma.

The body may still show a slightly undulating outline, but no longer throws out pseudopodia.

The pigment, coarser than before, and often showing an ex-

tremely active vibratory movement, is usually arranged about the periphery. The clear round or oval space thus left at or near the centre, is supposed to be occupied by the nucleus.*

The free forms in the plasma often appear to be swollen to a size much larger than a red corpuscle.

Of these full-grown bodies some go on to segmentation, some apparently degenerate and become fragmented or vacuolated, many are devoured by phagocytes. In some cases a certain number develop into flagellated bodies.

The Segmenting Bodies.

These forms were found from two hours before the beginning of the paroxysm to four hours after that time. They were seen in greatest numbers just before and during the chill.

For the purposes of this article it is unnecessary to describe in full the appearances observed, since they correspond in general to the descriptions usually given, and are sufficiently well indicated in the plate.

In the course of the development of the segmenting bodies from the mature forms, it was noticed that the forming segments seemed actually to push the coarse, motionless pigment granules before them. When segmentation began at the periphery, therefore, in the rosette forms, the pigment was crowded together in a central group or block. When, as more frequently happened, spore-formation occurred throughout the whole body at once, the pigment would be massed at an eccentric point, or crowded into a line, straight or curved, or it would be scattered in irregular groups throughout the body between the segments.

One observation may be given in detail as bearing on the entrance of the young parasite into the red cell—a phenomenon which few observers believe they have actually witnessed.

In this instance a group of entirely separated segments were collected about the central pigment block in a rather thick part of the specimen. A sudden slight current, apparently caused by the drying at the edge of the cover-glass, swept the whole cluster of twenty spores into an open space in the plasma, and scattered them through the field.

* See Mannaberg,² p. 29.

Each segment showed a rapid oscillatory movement of its own for some time after the current (which had been so slight as hardly to stir the red cells) had entirely ceased. This was probably simply Brownian movement, as the film of plasma was here thick enough to hold the segments in suspension, and the pigment block showed the same movement. The shape of each spore as it revolved in the plasma was seen to be irregularly polyhedral—evidently from the previous compression. The highly refractive nuclear dot could be plainly made out in each—apparently near the apex of the polyhedron. The oscillatory movement, at first quite rapid, gradually became slower, and at the same time the bodies became more rounded, the nuclear spot still showing distinctly.

After half an hour movement had ceased, and the appearance of apparent vacuolation often observed in free spores and in intracellular hyaline forms, set in. Here, as in the intracellular bodies, a clear shining ring developed about the central portion, separating it from the outer zone of the spore. The enclosed central portion then approached the outer zone and finally met it, leaving a clear, sharply outlined crescentic space at the centre of the body.* In several of the segments the highly refracting nuclear dot could still be made out in the portion enclosed between the horns of the crescent.

At the time this cluster was first scattered, one spore lodged among a group of red cells. After a few minutes, when the movements of the rest of the free segments had become slower, this body seemed to have indented the surface of one of the red corpuscles, and it was thought that a slight amœboid movement could be made out. Short projections could certainly be seen extending in four directions from the spot where the spore rested against the red cell. After half an hour this body still presented slight projections at two points on its outline, and the surface of the red cell seemed slightly dimpled at these points. The remainder of the outline of the body was rounded, and it presented precisely the appearance of a small intracellular hyaline body. It continued to change its shape slightly and quite slowly—the nuclear spot still being visible at the side opposite the projections. It finally became more sharply outlined, assumed the ring shape, and then the crescentic form as described above, appearing at this last stage simply as a vacuole in the red cell.

* This appearance is indicated in some of the free spores in the plate.

These observations afford no positive evidence that the spore actually penetrated the substance of the corpuscle, but the changes of form, though slight, were strikingly similar to those seen in intracellular hyaline bodies, and suggest at least an attempt on the part of the spore to enter the red cell.*

The Degenerate Forms.

Fragmentation, "gemmation," and vacuolation may be observed in the swollen extracellular forms at nearly all periods of the cycle. These changes, apparently retrograde in character, seem to be most marked when the infection is dying out spontaneously or after quinine has been given.

The fragmenting and budding processes require no detailed description here. The plate shows some of the common appearances.

One instance of vacuole-formation which was closely watched for a considerable length of time is of interest on account of the likeness of the body, at one stage, to a segmenting form. The specimen was taken six hours after the administration of twenty grains of quinine. A moderately large extracellular form, with rather coarse, slowly moving pigment, was seen to swell somewhat as it lay motionless in the plasma. Ten or twelve faintly outlined circular spaces, about the size of forming spores, now appeared throughout the body, each showing at its centre a faint darker shading. The body now became more swollen, the pigment granules ceased to move, the circular areas expanded a little, and became more distinctly outlined, while their darker central portions appeared as quite clearly defined round dots. The appearance at this time was very similar to that of a segmenting body with scattered pigment. Soon afterward the rounded central spot in each circular space moved outward until it met the outline enclosing that area. Clear crescentic spaces were thus formed in the body, which were evidently vacuoles. At the same time smaller circular spaces began forming near the periphery of the body, and the appearance of vacuolation was soon complete.†

This formation of crescentic spaces was quite similar to the

* See Mannaberg,² p. 45. Also Marchiafava and Bignami (Trans.),⁵⁷ p. 190. Also Welch,⁷ p. 26.

† These appearances are indicated in the first three figures in line VII of the plate.

changes occurring in separate spores, and in intracellular hyaline bodies when the specimen grows old.

The vacuoles in the extracellular forms sometimes present the appearance of large irregular spaces separated by a reticulum of protoplasm, being apparently formed by the coalescence of several smaller vacuoles. In these large spaces may be seen one or more separate rounded bodies, smaller than the divisions of a segmenting body, which are apparently fragmented portions of the protoplasm.

Phagocytosis.

The leucocytes exhibit their greatest activity at the time of the paroxysm, when the extracellular forms of the parasite are most numerous. When a specimen taken at this time is studied in the thermostat, or in a warm room, the large extracellular bodies (including the degenerate forms), the segmenting bodies, the free spores and pigment blocks, and the flagellate forms may each be seen to be pursued and engulfed by the polynuclear neutrophile elements of the blood. Pigment granules are sometimes found in the eosinophile cells, but no pigmented mononuclear leucocytes were observed in our specimens.

Between the paroxysms, when most of the organisms are intracellular, phagocytosis occurs but rarely. Now and then a belated large extracellular form, or a half-grown body escaped from its corpuscle, may be engulfed, and occasionally a distorted red cell is found embedded in a leucocyte containing pigment.

Leucocytes containing pigment blocks or granules may be found at almost all times during the cycle.

Sometimes two or three phagocytes will attack the parasite at the same time, and these may finally fuse into a large shapeless mass of protoplasm enclosing the organism in its midst.

An actively amœboid leucocyte has been seen to push aside several red cells which formed a barrier between it and the parasite, and an advancing pseudopod will sometimes crowd an organism against an opposing red cell with such force as to indent deeply the margin of the disc.

Bodies engulfed by the leucocytes may often be made out within their substance for some time afterward, and the dancing of the pigment granules frequently continues until the organisms are digested.

Pigment which was motionless before the body was swallowed, is sometimes seen to renew its activity within the leucocyte.

Not infrequently a body will be attacked by a leucocyte which already contains pigment granules or undigested portions of other organisms.

One specimen containing many large extracellular and segmenting bodies was studied for three hours on a hot day. At the end of that time the polynuclear leucocytes still showed considerable activity, and nearly all contained pigment or fragments of organisms. There was at the same time a distinct decrease in the number of free bodies to be found in the plasma.

The Flagellate Bodies.

These forms are usually found at or near the time of the paroxysm—occasionally during apyrexia. In the table, the two observations of flagellate bodies entered at twenty hours were made in a case showing two groups of organisms but only a tertian fever. These flagellated forms, therefore, probably belonged to the weaker generation of organisms, which, had they been present in greater numbers, would have caused a paroxysm soon after the flagellate bodies were observed. In this case too, quinine had been administered before the flagellated forms were found.

The flagella were one to three in number in our specimens, always given off from the full-grown extracellular forms with exceedingly active pigment granules, and never appeared until fifteen minutes or more had elapsed after preparing the specimen.

Only nine flagellate bodies in all were found in our cases. These were observed in seven specimens prepared from the blood of three patients.

Three of these bodies, presenting appearances of especial interest, will be described in detail :

1. One was an ovoid body, at either pole of which was attached a rapidly vibrating flagellum. The movements of these appendages were so active that the pigment granules in the body were apparently shaken into a single crowded mass, which lay almost motionless at one end of the ovoid. Later on, when the vibration of the flagella became slower, so that their wavy outline could be seen, the pigment became more scattered and resumed the usual lively dancing

motion. The flagella were finally withdrawn into the substance of the body, the latter expanding appreciably as it absorbed them. The pigment, still collected at one end of the body, continued its active vibratory motion as long as the organism was watched.

2. In another instance no flagellum was seen at first, but attention was attracted by a remarkably rapid oscillation exhibited by a group of the pigment granules at one side of the body—as if they were being violently shaken to and fro. The pigment in other parts of the body showed merely the ordinary dancing motion. This extremely rapid vibration was seen to become all at once much slower, then almost ceased, while a number of the pigment granules flowed out of the body into a single, rather broad flagellum, revealing for the first time its presence and outline. After a few seconds the rapid vibration of the flagellum, and with it the violent to-and-fro movement of the pigment at that side of the body, began again. Except for one or two granules which remained caught here and there, the pigment which had entered the flagellum was now shaken back into the body. The flagellum itself, grown long and narrow, vibrated so rapidly that its outline could no longer be made out, and the pigment lodged in it showed only as one or two dark blurs. These intermittent vibrations continued for some time, finally becoming slower and less frequent, the flagellum at the same time growing shorter, until ultimately it was absorbed into the body. The pigment granules at the spot where the flagellum was absorbed continued to exhibit intermittent vibratory motion for some time longer. Finally this ceased also, and the organism then appeared as an ordinary extracellular form with slowly dancing pigment. A clear nuclear space persisted near the centre of this body through all these changes.

3. In a third flagellate form the presence of a flagellum was suspected on account of a peculiar intermittent oscillation among all the pigment granules at once. A disturbance among the surrounding red cells was next noticed, and a long slender flagellum was seen in active motion at that situation. A small bulbous projection was now observed protruding from the body near this flagellum. This protuberance gradually elongated, being at first straight, but beginning to bend as it still grew longer, then waving from side to side more and more rapidly. It still slowly lengthened, until it was about twice as long as the diameter of the body. Here its

length remained stationary for a time, both flagella being now in extremely active continuous motion. A red cell floating between them was actually whipped until it rotated like a top. The vibratory motion of both flagella then became slower, allowing their snake-like undulations to be plainly seen. At this time both flagella began to grow longer, reaching finally a length of about four times the diameter of a red cell. As they increased in length, the body diminished appreciably in size, their growth being evidently at the expense of the content of protoplasm in the organism. Both flagella now became detached from the body, and for some seconds were seen actively wriggling about among the red cells. They finally slid over the boundary of the field and were lost to view. The attenuated body remained as a small extracellular form with its slowly moving pigment granules crowded closely together. The nuclear clear space, which had been present in this body at first, disappeared when the flagella broke away.

Since these observations were recorded an important advance has been made in our knowledge of the nature of the flagellated bodies. MacCallum,⁶⁸ of Baltimore, has published recently an account of the flagellated forms of a hæmatozoan occurring in crows, the "Halteridium" of Labbé. The following is a brief summary of his description :

In the blood of these birds, adult forms of the parasite which have been extruded from the corpuscles are found in two distinct varieties. The protoplasm in one of these forms is granular, and stains readily with methylene-blue ; in the other it is hyaline, and does not take this stain. The latter bodies frequently develop flagella, the former never do. The flagella, when developed, break away from the hyaline bodies and swarm about the nearest granular form, beating against its sides in an evident attempt to enter it. A single one of these flagella succeeds in inserting its rounded extremity or "head" into the body, and finally wriggles its way inside, churning up the contained pigment for awhile after being absorbed. After fifteen to twenty-five minutes the granular form thus entered assumes an ovoid shape, the pigment being collected at one end in a small spherical appendage, while the opposite end is hyaline, and presents a conical process. This fusiform body is provided with a refractive nuclear area, and possesses remarkable power of locomotion. This is the body described by Danilewsky⁶⁹ as a "vermicu-

lus." It moves about in the blood with great activity, puncturing the red cells with its conical anterior end, and sometimes dashing through a leucocyte, tearing it open, and scattering its granules in the plasma.

The above changes, therefore, are regarded as "a sexual process with a resulting motile form, occurring under unfavorable circumstances, analogous to similar processes in plants and lower animals. The vermiculus has power of penetration by means of its pointed anterior end, and may thus escape through the intestinal wall."

In the blood from a case of æstivo-autumnal fever, MacCallum has seen this same sexual process, the flagella breaking away from the parent body and beating against a quiet extracellular organism in which the pigment was arranged in a ring. One flagellum finally plunged its head into this body, and was soon after absorbed, stirring up the pigment for some time after its entrance. No motile vermiculus, however, resulted from this conjugation.

In the light of this discovery the flagellate forms, described above, take on a new meaning. Let us briefly reconsider their salient features with the idea of the "vermiculus" in view.

1. The first was a fusiform body into which, after a period of intense vibratory activity, *two* flagella entered instead of the single one observed by MacCallum to gain admission in the case of the Halteridium and of the æstivo-autumnal parasite. The final appearance presented by this body suggests the "vermiculus," the pigment, although more scattered than at first, being still collected at one end. The fact that the pigment was crowded into an almost motionless mass at the time when the flagella were vibrating most actively, would indicate that the origin of the motion exhibited by this form was not in the body itself, but in the flagella.

2. In the second flagellate body it is still more strikingly suggested that the flagellum had become affixed to the body from without. Here the pigment showed violent commotion only at the point of attachment of the flagellum, the granules in the rest of the body being comparatively quiet. This single flagellum finally entered the body after a series of rhythmic vibratory movements which might well be purposeful. The pigment at the spot where the flagellum was absorbed was churned up for some time after the entrance of the flagellum. This body, moreover, presented throughout these changes the nuclear space found in the "vermiculus."

It is believed, therefore, that these two forms represent the first stage in the development of "vermiculi" after the attachment of the free flagella.

3. In the third flagellate body we are evidently dealing with a wholly different phenomenon. Here the rapid vibratory motion occurred simultaneously in all the pigment-granules at once and in the flagellum, indicating that the source of this motion was in the body itself. Moreover, a second flagellum was actually seen to develop from the substance of this body. Both flagella grew visibly in length at the expense of the body's protoplasm, and finally broke away, moving about actively as free forms in the field. The nuclear space present up to this time was obliterated in the shrunken remnant by invading pigment.

This form, then, produced the free flagella designed to fertilize certain receptive extracellular bodies by the process observed in the first two forms.

Here, then, is represented an attempt on the part of the parasite to create a resistant body, the motile "vermiculus," apparently designed to escape from an unfavorable environment and perpetuate the existence of the organism elsewhere than in the blood. In this connection it is interesting to note the conditions obtaining in the patient whose blood furnished these specimens. All three forms occurred in the patient infected by two distinct groups of organisms but showing only tertian paroxysms. The last two forms, 2 and 3, were found at the time of maturity of the group which was dying out and incapable of producing a febrile reaction. Moreover, a single moderate dose of quinine had been administered when this group was half-grown. Add to these conditions the fact that the blood had been out of the body for some time when these forms were observed, and we have a combination of "unfavorable circumstances" which might well induce the parasite to assume a more resistant form.

The same sexual process, therefore, resulting in the fully developed "vermiculus" in the case of the *Halteridium* in crows, and demonstrated by MacCallum as occurring in æstivo-autumnal infections, is here indicated for the parasite of tertian malarial fever.

Summary.

The tertian malarial organism as observed in New York, therefore, shows no essential points of difference from the same type of parasite as found elsewhere. The tertian attacks of chills and fever are caused by infection with a single generation of the parasite. The occurrence at the same time in the blood of bodies at two distinctly different stages of development, always indicates a double infection, usually accompanied by quotidian paroxysms. Such a condition would be represented at different periods by the association in the same specimen :

1. Of hyaline with half-grown intracellular forms.
2. Of very young pigmented bodies with intracellular forms approaching maturity.
3. Of half-grown intracellular with segmenting bodies.
4. Of half-grown with mature intracellular forms.

As the large extracellular and fragmenting forms are to be found at almost any time in the cycle, their presence gives no definite clew as to the grouping of the organisms. It is to the intracellular forms, together with the segmenting bodies, that we look for information as to the character of the infection. From their study we are able also to determine what period of the cycle is present, and to predict with considerable accuracy the subsequent course of the attack.

Furthermore, when the organisms present are not arranged in distinct groups, or when organisms at several different stages of development are found in the blood at the same time, we may consider that we are dealing with a case of "irregular malarial fever," which will show an erratic temperature-curve, often of a more or less continuous type.

As to the parasites giving rise to the other types of malarial fever, the organism of quartan infections is unknown to us. The æstivo-autumnal parasite as it occurred in the two cases of this infection observed by us, afforded so little opportunity for exhaustive study that no consideration of this organism can here be introduced. The forms noted will be discussed later in the detailed reports of these cases.

ANALYSIS OF THE TERTIAN CASES WITH REFERENCE TO THE ORGANISMS.

Two of our 87 cases were examples of infection with the æstivo-autumnal parasite; the remaining 85 of infection with the tertian organism.

Following is a classification of the tertian cases.

	Hospital.	Dispensary.	Total.
Single tertian infections	33	22	55
Double tertian infections.....	21	9	30

CLASSIFICATION OF TERTIAN INFECTIONS BY MONTHS.

	May.	June.	July.	August.	September.	October.	Totals.
Single infections.....	4	16	18	10	6	1	55
Double infections.....	1	5	16	3	5	0	30
Total	5	21	34	13	11	1	85

The greatest number of cases of tertian fever, therefore, occurred in July, which was the hottest month of this particular year.

In this month there were but two more cases of single tertian infection than in June, when the next largest number of cases occurred, but there were more than three times as many of the severer double infections. The total number of all cases occurring during the four cooler months (*i.e.*, May, August, September, and October) was less than the number occurring in the single hot month of July. Moreover, the number of double infections in this month was greater than in all the other five months together.

THE SINGLE TERTIAN INFECTIONS.

Fifty-five cases of single tertian infection were treated, of which 33 were ward patients, and 22 were dispensary cases.

I. *The Ward Cases.*—Of these 33 cases, 2 were relapses. A third left the hospital apparently cured of his single infection, but failed to take quinine as directed after leaving, and returned twelve days after discharge with a double infection.

Three cases showed spontaneous recovery. One of these had had tertian paroxysms for two weeks, the second for five days, while

the third case had his only paroxysm on the day of admission. The fever, which was present in all three cases on entrance, disappeared in each within twelve hours, and no further symptoms occurred. The typical tertian organisms found in all on admission, rapidly disappeared from the blood. The treatment in the hospital was simply rest in bed on a fluid diet, and as none of these cases, so far as could be learned, had taken quinine before entrance, the recovery in each must be regarded as spontaneous.

In one of the 33 cases the paroxysms showed postponement; in three cases there was anticipation. Of the latter, one case anticipated four hours at each paroxysm; a second, two and one-half hours; while in the third case, two successive paroxysms occurred at the same hour, 10 A.M., but the following two began at 8 A.M., after which quinine was given and no further symptoms occurred.

Organisms.—One group of typical tertian organisms was found in each of these 33 cases. Segmenting bodies were found in 7, in all at or near the time of the chill. No flagellate forms were seen.

II. *Dispensary Cases.*—The record of the histories of these 22 cases is very incomplete.

One case gave a history of quotidian chills for five days, but as only one group of organisms could be found after careful search, this case was classed as a single infection.

Another case gave a history of chills recurring every seven days on the same day of each week. This attack had lasted for eight weeks, the patient probably having taken quinine at each paroxysm.

Organisms.—A single generation of tertian organisms was found in all these cases.

Segmenting bodies were seen in only 1 of the 22 dispensary patients, and no flagellate forms were observed.

Summary of the Single Tertian Infections in the Hospital and Dispensary.

Fifty-five cases, therefore, showed the presence of a single generation of the tertian parasite in the blood, and with two exceptions the paroxysms recurred every other day. One of the exceptions was the dispensary case giving a history of daily chills, but as only one group of organisms was found, either the account given was erroneous, or the second group had disappeared. The other exception was the case which had weekly paroxysms.

Two of the 55 cases were relapses.

Three cases recovered spontaneously.

Two cases in the hospital had nocturnal chills.

Organisms.—Segmenting bodies were found in 8 of the 55 cases.

No flagellate bodies were seen in the single infections.

THE DOUBLE TERTIAN INFECTIONS.

There were 30 cases of this class, of which 21 occurred in the wards, 9 in the dispensary.

I. *The Ward Cases*.—Each of these 21 cases exhibited a daily rise of temperature in the hospital, or gave a history of quotidian paroxysms before entrance.

Two distinct groups of organisms were found in all but three cases. A history of daily chills was given in these three, but the blood-examinations were not thoroughly made, merely the presence of the tertian parasite being noted.

Two cases giving a history of daily chills before admission, showed only a tertian temperature in the hospital, but in each of these cases the presence of two groups of organisms was clearly demonstrated. In these cases, apparently, after the patient was put to bed on a fluid diet, the second group of parasites diminished to a number insufficient to cause a febrile reaction.

In a third case, giving a history of daily "chilly feelings" with fever for four days before admission, a slight rise of temperature occurred on the day between two well-marked paroxysms. A few organisms were found in the blood at a stage of development corresponding to the group of parasites causing this intermediate rise.

One case was evidently undergoing spontaneous cure when quinine was given. This patient gave a history of repeated tertian attacks for six months before admission. The present attack had lasted for sixteen days before entrance, with quotidian paroxysms. After admission to the hospital, although two groups of organisms were found, a single moderate rise of temperature occurred on the second day after the last chill outside. From this time the organisms steadily diminished in number—the extracellular fragmenting forms predominating—and no further symptoms occurred. Quinine was then administered to terminate the infection and prevent its recurrence.

Five of these 21 cases may be considered examples of "*Irregular Malarial Fever*" caused by the tertian organism.

1. A case giving a history of quotidian chills for two weeks before admission, for which she had taken quinine at irregular intervals. In the hospital the temperature chart [showed an irregular daily rise of moderate range lasting for six days. Two separate groups of organisms were present, but were irregularly arranged, being found at stages of development which did not correspond accurately to the temperature curve. Quinine was begun on the sixth day.

2. The second case gave a history of tertian attacks at varying intervals for four years. The last attack had occurred three months before the present illness, and during this last interval the patient had been under treatment at a dispensary, but felt sick and miserable all the time. The present attack had lasted five days before admission, with tertian chills. In the hospital no chills occurred, but the temperature chart showed an irregular daily rise for seven days, steadily declining in range. Two groups of organisms were found, but showed an irregular development with reference to the temperature curve. The organisms diminished as the fever subsided.

This case seems to have been a beginning double tertian infection which was yielding to favorable conditions of rest and diet when quinine was given to terminate it.

3. The third case was a child three years of age, who had an irregular fever for two weeks in the hospital, the temperature being continuously elevated at times for from thirty-six to forty-eight hours. Organisms were found at several different stages of development each time the blood was examined. In this case either the usual regular grouping was not preserved, or there was infection with several different sets of organisms.

4. The fourth case had had tertian attacks from time to time for four months previous to admission—the intervals between the attacks having been so short that the patient had paroxysms every other day for nearly the whole of that period. Two weeks before admission she was treated by a physician, and had no chills for ten days. Four days before entrance the chills returned, and were quotidian, the one on the day of admission having been severe. In the hospital no chills occurred, but for seven days there was an ir-

regular daily rise of temperature. Organisms were found at two different stages of development, but they were few in number, and the infection was evidently nearly spent, when quinine was given on the seventh day.

5. The fifth case was a Bohemian, from whom very little in the way of history could be obtained. He had had daily chills for three days before admission. The temperature chart showed a slight, irregular fever, which was continuous for twenty-four hours at one time, and for forty-eight hours at another. Tertian organisms were found, but their arrangement was unfortunately not noted. After four days quinine was given and the symptoms disappeared.

Organisms.—Segmenting bodies were found in 10 of the 21 ward cases of double tertian infection, always at the time of the paroxysm. Flagellate bodies were found in 3 cases, generally at the paroxysm, but in one case they were seen also at the maturity of a feeble group which was incapable of causing fever.

II. *Dispensary Cases.*—There were 9 cases of double tertian infection treated in the dispensary. Four of these cases gave a history of daily chills, of which one had had tertian chills for five weeks, followed by quotidian paroxysms for ten days before applying for treatment.

Three of the 9 cases gave a history of tertian chills, but in each of these two distinct groups of organisms could be demonstrated. They were, therefore, probably instances of beginning double tertian infection. Two of these three were brothers, aged four and six respectively, whose parents were treated at the same time for tertian malaria. All of this family except the four-year-old boy had had malarial fever at New Rochelle one year previously.

Another case also gave a history of tertian chills, but had taken quinine the day before she was seen at the dispensary. This may account for the fact that organisms were found at two different stages of development—or it may have been a beginning double infection.

The ninth case was a man of fifty-two, an example of irregular malarial fever with tertian organisms. He gave a history of chills recurring at very irregular intervals, and the blood showed organisms at several different stages of development.

Organisms.—Two groups of the parasites were present in each

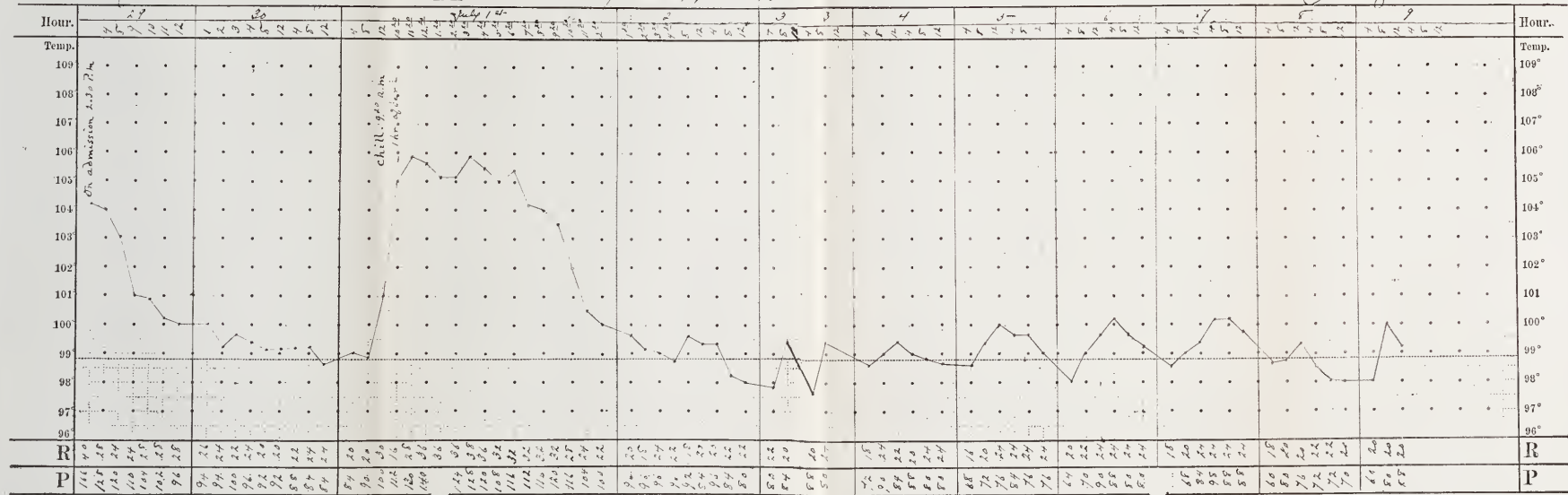
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Name Jessie B

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Date June 27, 1897

Date July 3, 1897



of the 9 cases. Segmenting bodies were found in 2 cases, in both at the time a paroxysm was expected.

No flagellate bodies were noted.

Summary of Cases of Double Tertian Infection in Hospital and Dispensary.

These amounted to 30 in all. One of the cases was a relapse of a previously treated single infection.

Two patients gave a history of tertian chills, but had an irregular daily rise of temperature in the hospital, and each showed the presence of two groups of organisms.

Of 4 other cases giving a tertian history, two distinct sets of organisms were found in each.

Organisms.—Two separate groups of the parasite were found in all but 3 of these 30 cases. In these three the blood-examinations were imperfectly made. They are classed as double infections, because the temperature charts of two showed a daily rise, while the third gave a quotidian history.

Six of the 30 cases were examples of irregular malarial fever, with tertian organisms. Segmenting bodies were found in 12, flagellate bodies in 3 of the 30 cases.

CASES OF TERTIAN MALARIAL FEVER.

1.—*Single Tertian Infection.*

CASE 273. June 29.

A. B., female; aged seventeen; German; has been in this country only two months.

Patient lives in the city, but goes to Brooklyn regularly once a week. Present attack began two days ago with a typical paroxysm—chill, fever, and sweating. Another paroxysm occurred on the morning of admission.

Physical examination, negative except for a palpable spleen. Had not taken quinine previous to coming to hospital.

On the day of entrance, eight hours after the chill, the blood showed numerous large extracellular bodies with fragmenting forms and pigmented leucocytes.

Next day, twenty-six hours after the last chill, there were many half-grown intracellular forms, all actively amœboid, several of which escaped from the corpuscles while under observation.

On the third day after admission, at the time of the chill, segmenting bodies were found, with many large extracellular forms. Phagocytosis was very active in this specimen. Six hours after this chill, hyaline intracellular organisms were found. One of these was seen to burst from the red cell, the latter becoming at once decolorized, two pale shadows being left in the field. Quinine, gr. v., was given as the temperature fell, and next day no organisms were found.

On July 3, the day a chill was due, none occurred, but a single active, full-grown intracellular body was found, so the former dose of quinine was repeated.

On July 5 no organisms were found, but a slight rise of temperature occurred at the time for the chill. This rise was repeated daily for the next two days, but still no organisms could be found. Quinine, gr. v., was given again and gr. ij., t.i.d. ordered.

No rise occurred on July 8, but on the 9th the temperature again rose to 100° F., and a single active extracellular organism of adult size was seen. Quinine was increased, and the patient left the hospital with instructions to continue its use.

This case is of interest, therefore, from the fact that after two moderate doses of quinine one chill was omitted, but beginning on the fifth day after the last paroxysm, a *quotidian* fever of slight range occurred until more quinine was given. This drug, then, administered in insufficient doses, diminished the number of organisms present and disarranged their grouping, so that the tertian attack became an irregular quotidian intermittent fever. This would probably have continued had not the quinine been increased, for organisms reappeared in the blood on the day of discharge.

2.—*Single Tertian Infection Relapsing as a Double Infection.*

CASE 367. June 18.

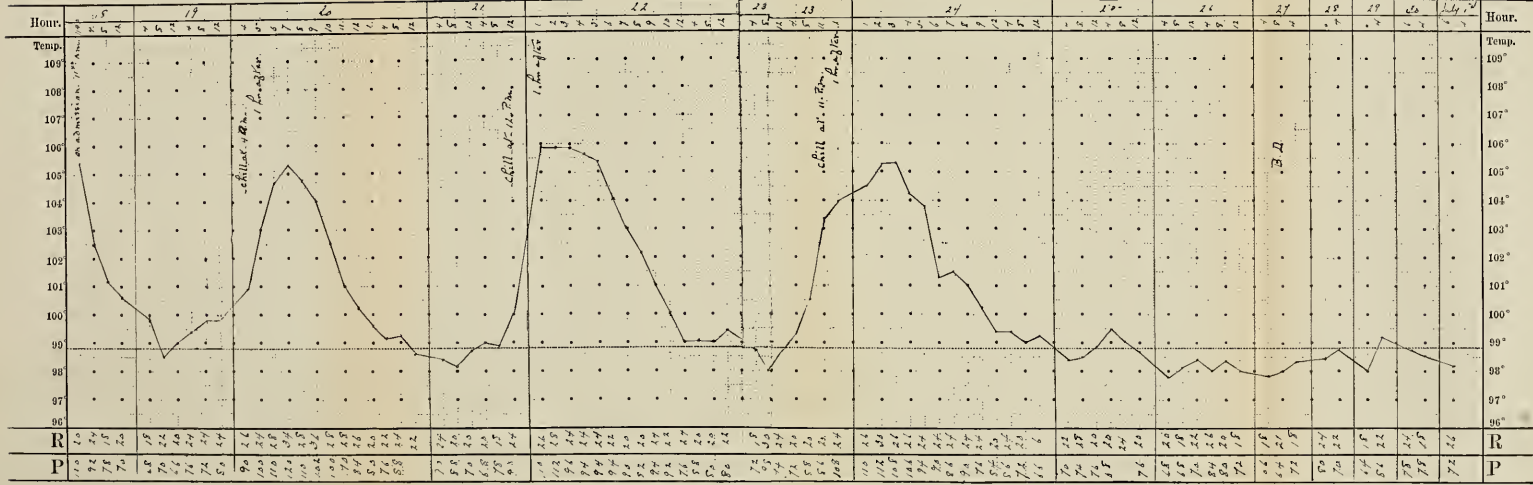
A. S., male; aged thirty. An example of an anticipating tertian intermittent fever arrested by quinine, afterward relapsing as a quotidian fever.

This patient gave no previous malarial history, and had not been out of New York City for nearly a year. The street, one block away

Name Lebert S

Date June 18th 1897

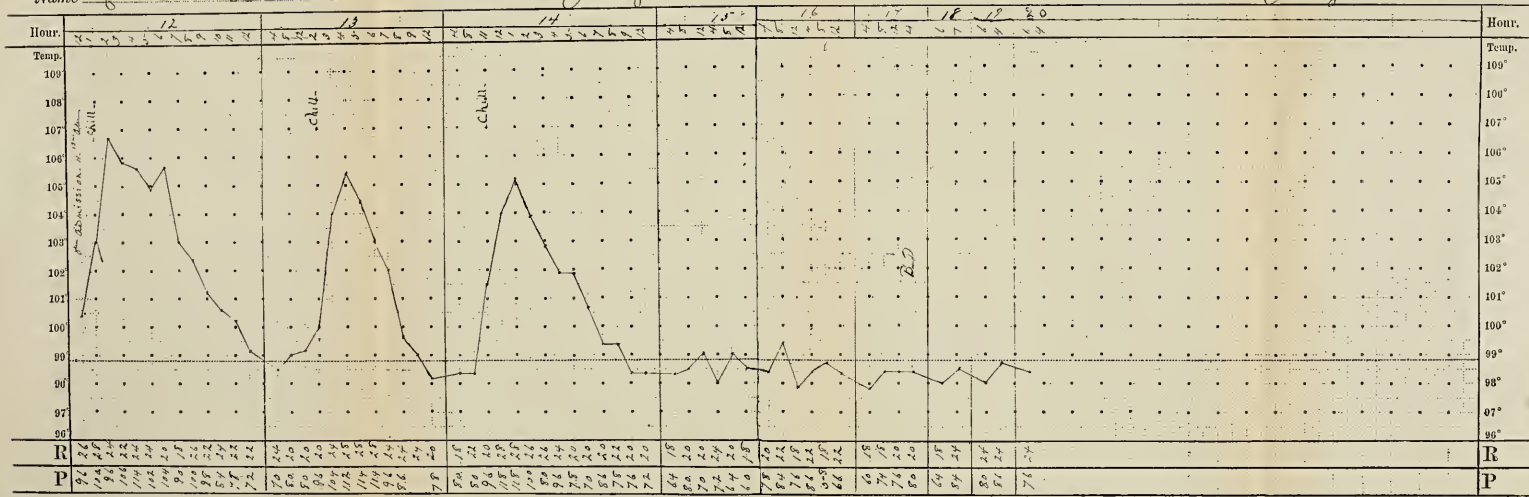
Date June 23rd 1897



Name Robert B. S.

Date July 12 - 1897

Date July 16 - 1897



from his residence, was being repaved when the attack began, one week before admission. Well-marked paroxysms occurred every other day until entrance, the last chill taking place on that morning.

He complained of severe pain in the back, and had been treated for lumbago outside.

Physical examination, negative except for palpable spleen.

The blood was not examined until the day after admission, when typical half-grown intracellular and fragmenting extracellular forms were found.

The three paroxysms occurring after entrance showed an anticipation of about four hours each time—although the last chill did not occur until some three hours after the temperature first exhibited a decided rise. This initial elevation, which indicates the beginning of the paroxysm much more definitely than the chill, was first distinctly present at 4 A.M. on June 20, at 12 midnight on June 21, and at 8 P.M. on June 23. The four hours' anticipation is thus shown very clearly by the temperature curve—but only two of the chills corresponded to the initial rise.

Organisms were found at stages of development corresponding to the temperature curve each day until the 24th, when, at 5 P.M., all organisms had disappeared—quinine, gr. xx., having been given in a single dose on the 23d, eight hours before the paroxysm. No further symptoms occurred, and no more organisms could be found after repeated search. The patient was therefore discharged on the thirteenth day after admission—seven days after the last chill—with instructions to take quinine at home. Through some misunderstanding he failed to do this, and felt weak and miserable after leaving the hospital. On the fourteenth day after the last chill he had another, and this was followed by daily paroxysms until he re-entered the hospital, twelve days after discharge. Examination on admission showed marked anæmia and a spleen reaching two inches below the costal arch.

On the following day, twenty-four hours after the last chill, many half-grown bodies, with full-grown and segmenting forms, were found in the blood.

Three daily paroxysms occurred after entrance. The blood, examined daily, continued to show two distinct groups of organisms.

Seven grains of quinine were given at the paroxysm on the second day, and repeated at the one on the third day. On the

fourth day no fever existed, and no organisms could be found in the blood, and after this, recovery was uneventful. The patient left the hospital this time with his quinine in his pocket to be taken at home.

In this case, therefore, one dose of twenty grains of quinine destroyed nearly all of the single group of organisms at first present, at the same time altering the development of those remaining in the blood, so that when the latter had multiplied sufficiently to cause symptoms, they were arranged in two groups, and produced daily paroxysms.

3.—*Double Tertian Infection made Irregular by Quinine.*

CASE 229. June 19.

L. H., female, aged eighteen. No previous malarial history ; always well.

Two weeks ago, while living in Jersey City, she began to have typical quotidian paroxysms about 5 P.M. daily. Patient has taken irregular doses of quinine and the chills have been less severe of late. Physical examination is negative except for an enlarged spleen.

On the day of admission half-grown intracellular and large extracellular bodies were found in the blood. This was twenty-four hours after the last chill, and only a slight rise of temperature occurred on this day. Next day a slight chill occurred and temperature rose to 101.5° F. Full-grown extracellular bodies were found at this time. Two days after this a more severe chill occurred, and the temperature rose to 104.5° F. A single half-grown intracellular form, one hyaline body, and many vacuolating and fragmenting extracellular bodies were observed in the blood during the paroxysm. Twenty-two hours after this chill very young pigmented bodies, half-grown intracellular, and fragmenting extracellular forms were seen in the same specimen, the temperature showing a slight rise a few hours afterward. Next day, the sixth day after admission, quinine was given, and organisms and symptoms disappeared thereafter.

This case of double tertian infection, therefore, having taken quinine irregularly, showed after admission an irregular daily rise of temperature with one or two abortive paroxysms, and the grouping of the two generations of the parasite did not exhibit the usual regular arrangement.

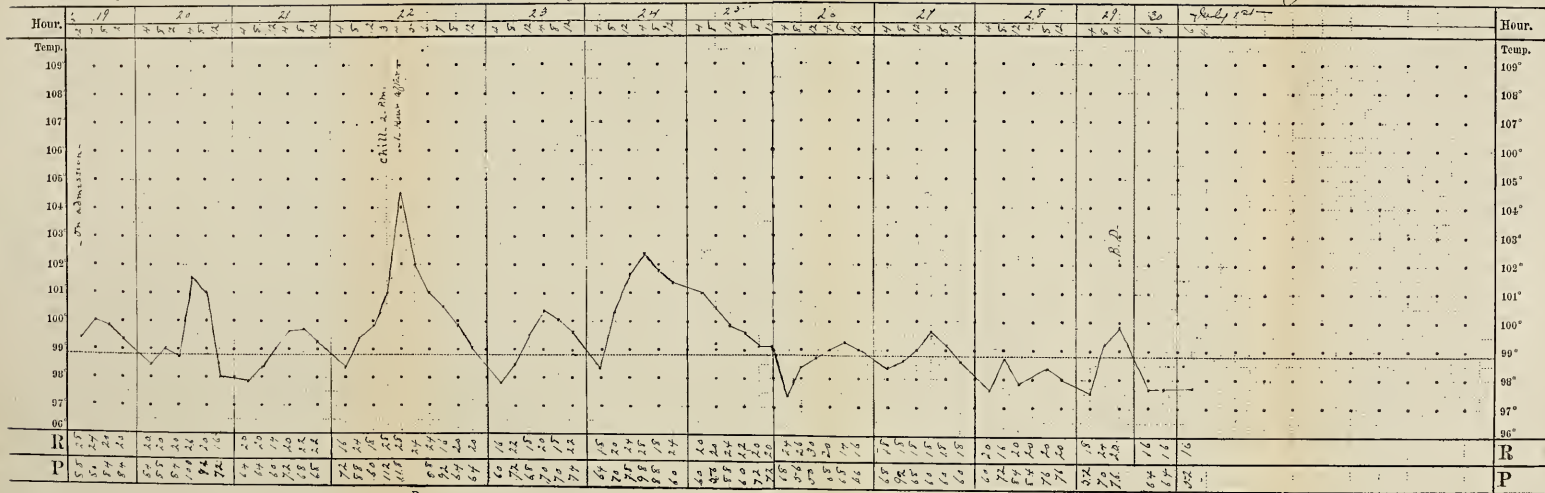
Name Lippin A.

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Date June 18 - 1897

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Date June 26 - 1897



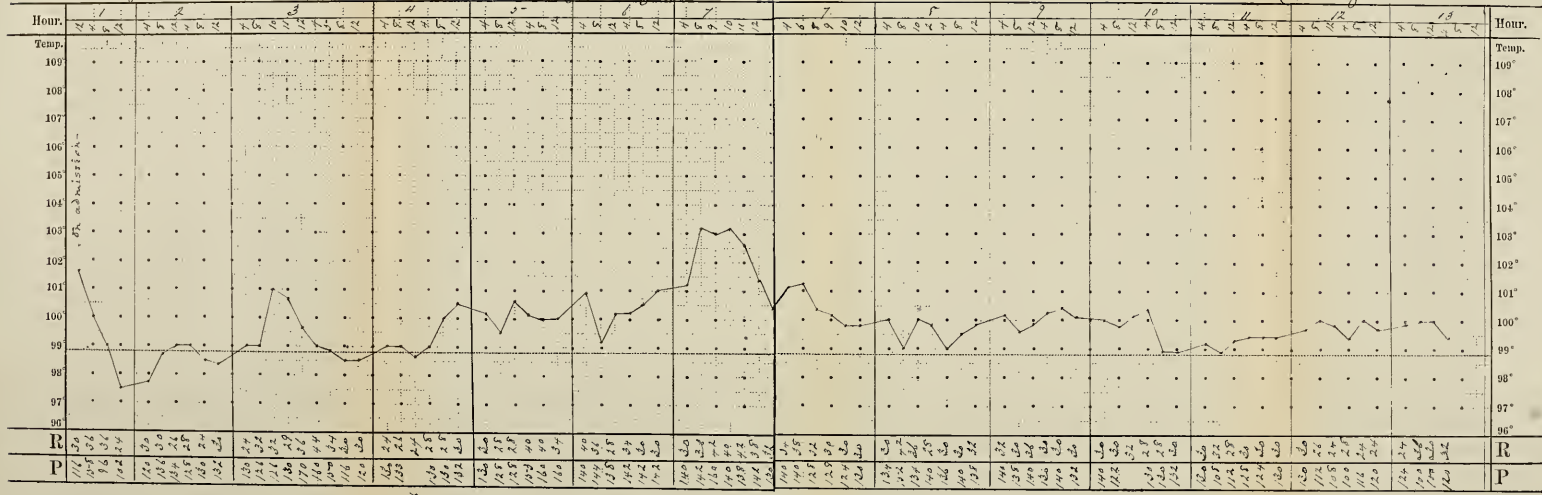
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Date July 7 1897

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Date July 7 1897



4.—Multiple Tertian Infection Causing Irregular Fever.

CASE 286. July 1.

M. M., female; aged three. History is meagre; probably never had malaria before. Lives in the city. Physical examination, negative except for an enlarged spleen.

Repeated examinations of the blood were made during the first three days after admission at intervals of from eight to sixteen hours, and at each of these times young pigmented, half-grown, nearly mature, and mature intracellular organisms, with fragmenting extracellular bodies were found. There were no chills in the hospital, but the temperature showed the irregular course that would be expected from the presence of organisms in nearly all stages of development. This temperature, as is shown by the chart, frequently remained continuously elevated for from thirty-six to forty-eight hours or more, although for the most part it was of low range.

In this child, therefore, the irregular fever seems to have been caused by infection with several different groups of organisms. This condition may have been due to a lack of resistance on the part of the individual.

Small doses of quinine given three times a day finally caused disappearance of fever and organisms.

CASES OF ÆSTIVO-AUTUMNAL FEVER.

CASE 625. September 20th.

M. L., female; aged thirty-seven. No previous malarial history. Has not been out of New York for five years. Present attack began three weeks previous to admission with distinct tertian paroxysms. Lately the symptoms chiefly complained of have been vomiting and pain in abdomen, particularly over the liver and spleen. The patient states positively that she still feels comparatively well on the intermediate days.

Physical examination, skin a little yellowish. Liver, upper border fourth space, edge is felt three and one-quarter inches below free margin in right parasternal line; tender to palpation and percussion. A few scattered râles over hepatic area. Spleen, percusses large, and edge is felt two inches below costal margin; is also quite

tender. Examination otherwise negative, except for a soft systolic murmur at apex of heart.

In this case the blood was examined several times during the first three days in the hospital, but no organisms were found. The scattered râles over the enlarged and tender liver, together with the slight icterus, suggested hepatic abscess. Finally, on the fourth day, crescentic bodies were found in the blood, and the diagnosis was established.

At 3.30 P.M., on September 23d, there were found beside the crescentic bodies, a few extracellular rounded organisms of moderate size, with coarse, sparsely scattered, nearly motionless pigment; small hyaline intracellular forms, some ring-shaped, some actively amœboid, and larger intracellular amœboid forms with coarse, scanty pigment in slow motion at the periphery or grouped nearer the centre. The diameter of the latter forms was fully one-half that of the red cell. Intracellular organisms of this kind are said to be found only just before and during the paroxysm, disappearing promptly with the fall of the temperature.* The small hyaline bodies are almost or entirely absent for several hours before and during the early part of the paroxysm, but appear in considerable numbers later in its course and immediately after it. At this time, 3.30 P.M., on September 23 (as will be seen on the chart), the temperature, having declined after the rise on the preceding day, was still somewhat elevated, and showed a second sharp rise a few hours later without having reached the normal.

The occurrence of considerable numbers of the hyaline bodies with the larger pigmented intracellular forms would indicate, in spite of the low temperature, that this was the middle of the paroxysm. Again, leucocytes containing pigment blocks were also found at this time, showing that segmentation must have already taken place in the internal organs. These considerations lead us to believe that the two rises of temperature on the 22d and 23d represent a single long paroxysm of the "æstival-tertian fever" of Marchiafava and Bignami,⁵⁷ characterized, as described by them, by an "initial rise" (on the 22d), a "pseudo-crisis" (morning of the 23d), the temperature not reaching normal, but going on to a "precritical elevation" (evening of the 23d), and finally the "crisis."

Precisely the same appearance of "pseudo-crisis" and "pre-

* The Malarial Fevers of Baltimore,³ page 91.

Name Harry R

620-

Date September 20th

620-

Date September 27th 1897

Hour.	20	21	22	23	24	25	26	27	28	29	30	Oct 1	2	3	Hour.
Temp.															Temp.
109															109°
108															108°
107															107°
106															106°
105															105°
104															104°
103															103°
102															102°
101															101°
100															100°
99															99°
98															98°
97															97°
96															96°
R	103.5	104.5	103.5	104.5	103.5	104.5	103.5	104.5	103.5	104.5	103.5	104.5	103.5	104.5	R
P	103.5	104.5	103.5	104.5	103.5	104.5	103.5	104.5	103.5	104.5	103.5	104.5	103.5	104.5	P

on admission 2.30 P.M.

B.D.

critical elevation" is shown by the temperature curve on the 20th and 21st, while the "initial rise" of the 24th occurred after quinine had been begun, and the paroxysm was therefore cut short. The complete paroxysm of the 22d to 23d lasted thirty-six hours. In this case the tertian character of the fever is somewhat masked by the exaggerated pseudo-crises—but the characteristic drop of the temperature to subnormal between paroxysms is distinctly tertian. The history of the case is further confirmatory of this tertian type, there having been distinct tertian paroxysms at first, and the patient stating positively that she felt comparatively well on alternate days throughout. The symptoms in the hospital also correspond to tertian paroxysms. There were no chills, but nausea and vomiting accompanied the initial rise on the evenings of September 22 and 24, and the patient complained of severe abdominal pain referred to the regions of the liver and spleen on September 21 and 23, the days when the temperature was continuously above normal. On these days there was little or no sweating; on the intermediate days, the 22d and 24th, when the temperature fell below normal, there was profuse sweating, but little or no pain.

On September 24, at 10.45 A.M., during apyrexia, the blood showed crescentic bodies, some presenting distinctly the appearance of a double contour; an ovoid body also with an apparent double outline and with the "bib-like" remnant of red cell at one side, the pigment being coarse, motionless, and centrally placed; round extracellular bodies with coarse, motionless, central pigment. One of the latter showed "gemination"—three or four round droplets of protoplasm being extruded at one side. Another round body with slowly moving scattered pigment showed a pale crenated remnant of red cell attached to one edge. Several ring-like and amœboid hyaline bodies were seen, the result of the segmentation in the internal organs at the preceding paroxysm. One ring-like body watched for some time in the thermostat finally expanded, lost the ring appearance and became actively amœboid. One of the larger of the hyaline bodies showed three small pigment granules in slow motion at the periphery—as would be expected at this period between the paroxysms.

Quinine was begun on the 24th in doses of five grains every four hours. On September 25th the temperature rapidly fell to subnormal after an abortive rise. At 4 P.M. a single actively amœboid

hyaline body was found in the blood. No other bodies were seen after careful search.

From this time recovery was uneventful, and no more organisms were found, even the crescentic bodies having disappeared.

The life-cycle of the intracellular forms, therefore, so far as it could be traced in the peripheral circulation, seemed to show the presence of a single group of organisms, for the few stages of development at which these forms were seen corresponded very accurately with this æstival-tertian temperature curve. The crescentic, ovoid, and round bodies which are extracellular (or to which only the shrunken remains of the red cells are still attached), representing more resistant forms of the parasite which develop only after the fever has lasted for a week or more, give no definite information as to the paroxysmal cycle.

This, then, seems to have been a case of "æstival-tertian fever;" designated also as "malignant tertian" by Marchiafava and Bignami in contradistinction to the "benign tertian" of the spring months in Italy. Originating in New York City, this infection, although it had lasted three weeks when the patient entered, and the resistant crescentic forms were quite numerous, yielded readily to quinine in doses of five grains every four hours.

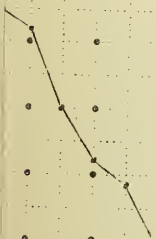
CASE 724. October 17.

C. F., male; aged twenty-four. No previous malarial history. Has not been out of the city for seven months. Present attack began two days ago when on his way to work, felt dizzy and couldn't see well. About 1 P.M. had a shaking chill and went to bed, then followed fever and sweating. Another less severe paroxysm yesterday about the same time. On the morning of admission he had a third chill. Physical examination is normal, except for an enlarged and slightly tender spleen.

This case seemed so clearly malarial that it was a matter of surprise when examination of the blood during apyrexia, on the day after admission, showed no organisms. On October 19, however, a paroxysm occurred, and at this time ring-like hyaline intracellular bodies were found in considerable numbers. Repeated examinations of fresh and stained specimens from the peripheral circulation failed to show any forms other than these small hyaline bodies. These, however, were unmistakable, both in the fresh and in the

21

4 5 6 7



4 5 6 7

2 3 4 5 6 7

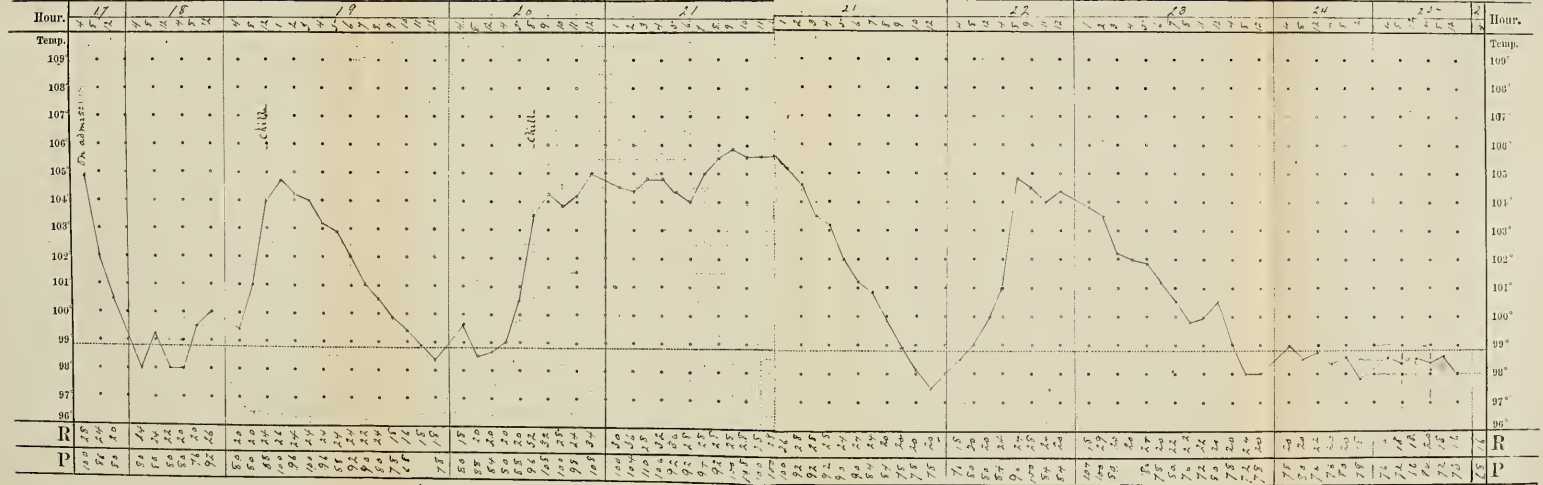
Name Charles F.

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Date October 17 - 1897

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Date October 21 - 1897



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80

stained preparations. Guaiacine was tried in this case from October 20th to the 23d in doses of seven grains, given three times on the first day and every six hours afterward. The paroxysm recurred on the 22d, however, and on the 23d guaiacine was stopped and quinine begun in doses of ten grains three times a day, after which the fever and organisms promptly disappeared, no crescents having developed.

This case, then, a primary æstivo-autumnal infection apparently originating on Manhattan Island, is of great practical interest. The attack had lasted only two days when the patient entered, and the striking crescentic and ovoid forms of the parasite had not yet had time to develop. The first examination was made several hours before a paroxysm, and no organisms whatever were found—as is to be expected in æstivo-autumnal infections. At the time of the paroxysm on the following day, only the small, ring-like bodies could be found—the smallest and most difficult of detection of all the malarial organisms. It may be readily understood, therefore, how an unskilful examination of the blood, or even a careful search at the wrong time, in a case showing such typical malarial symptoms, might lead to the conclusion that in such cases of New York malarial fever no organisms can be found. Yet they were there when they should have been, and were promptly destroyed by moderate doses of quinine, all symptoms disappearing at the same time.

This case seems to have been an example of “æstival-tertian” fever with prolonged paroxysms in which the “precritical elevation” was not always sharply defined—although its occurrence is indicated on the chart in the last two paroxysms, while in the paroxysm of October 18 to 19 the precritical elevation constituted the greater part of the rise. It will be noticed that in each of the paroxysms the time during which the temperature was elevated above normal amounted to more than twenty-four hours, the longest lasting thirty-two hours. The patient’s account of daily paroxysms before entrance is thus readily explained, a second chill, or “chilly sensation,” occurring on the day after the one ushering in the paroxysm proper, while the temperature was still elevated and probably at the time of the precritical rise, as happened on the 19th.

As the chill in any malarial fever is not invariably the initial stage in the paroxysm, the method followed here of taking the temperature every four hours before the chill and every hour after it until the normal is reached, often obscures the relations of the differ-

ent paroxysms. Thus, on October 18, the initial rise occurred between 4 and 8 P.M., but was not marked by a chill, the highest point at 12 midnight being only 100° F. The temperature then fell slightly (pseudo-crisis), but between 4 A.M. and 12 noon on the 19th a sharp rise occurred (precritical elevation), accompanied by a chill. After 1 P.M. there was a steady decline until normal was reached at about 10 P.M. Comparing this with the following paroxysms, it will be seen that the variations in the curve correspond closely as to time, but differ considerably in degree. The paroxysm of the 20th to 21st began with a sharp initial rise between 4 and 8 P.M., accompanied by a distinct chill. The highest point was again reached at 12 midnight, followed by a very slight "pseudo-crisis," then a pre-critical elevation of about two degrees, occurring between 6 A.M. and 12 noon on the 21st, about as before in point of time. Here again after 1 P.M. the decline was steady until normal was reached at 9 P.M.

In the last paroxysm on the 22d to 23d the initial rise was more gradual, occurring between 8 A.M. and 8 P.M., but the sharpest part of the rise was, as before, between 4 and 8 P.M. Here again after midnight the "pseudo-crisis" occurred, this time being so marked as to practically represent the true crisis, since the precritical elevation between 8 A.M. and 12 noon on the 23d was very slight, and normal was reached at 4 P.M.—earlier than before. The difference shown in this last paroxysm may have been due to the guaiacine, which had been given for two days previously.

In this case no determination of the grouping of the organisms could be made, owing to their scanty representation in the peripheral circulation.

In these two cases of æstival-tertian fever are represented nearly all of the modifications of the paroxysmal curve which were formulated by Marchiafava and Bignami⁵⁷ to account for the complexity of the appearances usually presented. These modifications are :

"(a) The lack of a sharp initial elevation, so that the curve rises in a progressive and continuous manner.

"(b) The exaggeration of the pseudo-crisis, so that the attack tends to lose its [tertian] individuality.

"(c) The prolongation of the paroxysm, which is usually associated with an exaggeration of the thermic oscillations during the fastigium.

"(d) The lack of a sharp precritical elevation."

TREATMENT.

In hospital practice, when we can control our patients, they are all put to bed and on a fluid diet, and kept there until at least three to four days after their last chill—except in cases of the more severe æstivo-autumnal infection, where it is agreed by most observers it is better to keep them in bed at least a week or ten days after their temperature has become normal to stay. Rest has been proven to be no small factor in aiding the disappearance of the organisms. A brisk cathartic is given the night of admission, usually calomel, followed by a saline in the morning. Full diet is usually begun the second day after their last chill.

Quinine, of course, was relied upon solely to effect a cure, and was universally used in all cases which had not undergone a spontaneous cure—even in these cases quinine was given to take after leaving the hospital in order to prevent a relapse, so common in cases supposed to have undergone such cure. Administration by mouth was the only method used, although in the worst cases, particularly the comatose type, subcutaneous injections must be used, as has been done in former years in a limited number of cases of that description seen in this hospital. The sulphate of quinine in solution was the one form used.

℞. Quininæ sulphatis..... gr. v.
 Acidi sulphuric. dil ℥l. vij.
 Aquam..... ad 3 j.

There were several methods of giving the drug employed in order to ascertain if possible the surest way to cause a speedy disappearance of the organisms. Single doses ranging from five to twenty grains, given on the fall of the temperature, was the one most systematically used, but doses every four hours or three times a day (the latter always, even after a single dose had apparently controlled the symptoms), or one large dose of twenty grains before the chill was expected, were also tried to some extent. At the beginning of the season the method of giving a small dose of quinine (gr. v.-vii.) as the temperature began to fall, was tried, and time and again such single small dose would cause a complete subsidence of the symptoms, and an examination of the blood would fail to discover organ-

isms. This single dose, however, was not trusted to have a lasting effect, for in one or two cases who failed to get more quinine the paroxysms reappeared in about one week; but the patients were started on the second day after the chill on five to ten grains three times a day, and were given five grains to take after each meal for two weeks after leaving hospital. As the season advanced, however, it was found repeatedly that such small dosage as five to seven grains on the fall of the temperature was not sufficient to control the paroxysms, and they reappeared on time the second or third day, either with their original force or at best only slightly modified. So it was found necessary to give much larger single doses of ten to fifteen grains or even twenty grains on the fall, before the symptoms were controlled. This fact is rather interesting as showing the increasing force of the infection as the season progressed.

The principle, of course, upon which small doses were given on the fall of the temperature was that the paroxysm and segmentation of malarial organisms are coincident, the former being caused by the latter; then a comparatively small dose seems to control the symptoms—the size of the dose depending on the advancement of the season. While the organisms are intracellular, even large doses are not able to abort the impending paroxysm, although they may modify it to some extent. Hence the conclusion is arrived at that the best method of treatment consists in giving fairly large doses when the paroxysm begins or on the fall of the temperature, then the repeated doses three times a day for at least two weeks.

It is safe to say that if this method is followed the chances for a relapse are small. A new infection is, of course, another matter, and one attack seems actually to predispose to another rather than to render the patient immune.

Observations on the length of time that it took the organisms to disappear from the blood after a single dose of quinine were made in 21 cases. Early in the season 8 cases that received a single dose of five to seven grains on the fall showed no organisms in the blood forty-eight hours later. The larger single doses were tried later in the season (gr. x.-xx.) in 13 cases, and all failed to show organisms in the blood forty-eight hours later. Hence the conclusion also that any dose which will cause the disappearance of the organisms from the peripheral circulation will do so in about two days.

The Action of Quinine in Delaying the Paroxysms.

This effect, following the administration of a single dose of quinine at the time of a paroxysm, was noticed in 10 cases of tertian infection. In 5 of these the drug was given to patients in the wards, and the organisms were studied in connection with the clinical manifestations. In the 5 remaining cases the quinine was taken outside the hospital, and the results of its action were determined from the accounts given by the patients.

In 4 of the 5 cases observed in the wards, after a moderate dose of quinine (gr. v.-x.) given at the paroxysm, the symptoms disappeared for from three to five days—the chills returning in 1 case on the fourth day, in 3 cases on the sixth day afterward. Organisms were found in 3 of these cases during the afebrile interval, and in all 4 when the symptoms returned, increasing in numbers if the paroxysms were permitted to continue. In the fifth hospital case an interval of thirteen days without paroxysms occurred after the administration of a single dose of twenty grains of quinine on the fall of the temperature. This was the case of single tertian infection reported elsewhere, who failed to take quinine at home and returned with a double infection.

Of the 5 cases who took quinine outside the hospital, 1 had an interval of nine days without chills after ten grains taken at a paroxysm. In the other 4 cases an unknown quantity of quinine was taken at the time a chill occurred. This was followed by an interval of eleven days in 1 case and of seven days in each of the other 3 cases. One of these last was the dispensary patient who had had a chill every Thursday for eight weeks. Quinine had been taken at the paroxysm occurring a week before the one in which the patient was seen, and it is probable that a similar dose had been taken at some at least of the preceding chills. The blood in this case showed full-grown and hyaline bodies of the ordinary tertian type.

The average interval in these 10 cases was about seven days, and the quantity of quinine taken, so far as could be learned, averaged about ten grains.

A moderate dose of quinine, therefore, exhibited at the time of a paroxysm, will destroy so many of the parasites that the remainder

require about seven days, on an average, to develop into a sufficient number to cause symptoms. During this interval a few organisms may usually be found in the blood, increasing in numbers as the symptoms return.

This action of quinine explains the possibility of controlling the disease by the method sometimes employed of administering a single *large* dose at the paroxysm, and repeating at intervals of a week for some time.

The cases of "malarial fever with long intervals," in which the chills recur about once in seven days, might thus be produced by giving only a *moderate* quantity of quinine at each paroxysm. These prolonged intermissions may also occur spontaneously, as first suggested by Bignami.⁷⁰ According to his hypothesis, the greater part of the group of organisms causing each paroxysm is destroyed in the blood during the high temperature, the patient then passing through a fresh incubation period of seven or eight days.

CONCLUSION.

As a result of our investigations, therefore, the following conclusions may be drawn :

Malarial fever as it occurs in New York presents no essential points of difference clinically or pathologically from the same types of the disease as observed elsewhere. The tertian infection is the form most commonly met with, the æstivo-autumnal variety is comparatively rare. Both these forms may and do originate *de novo* on Manhattan Island. The quartan infection is practically unknown here.

So far as the cases which came under our observation were concerned, the condition of general upheaval in the streets of the city during the past year did not seem to have the marked influence in causing the malarial attacks which is generally attributed to it.

Here, as elsewhere, the tertian cases are more numerous and the attacks more severe during or immediately following hot weather, and the few æstivo-autumnal infections appear in late summer and early fall.

The Irregular Malarial Fevers.

As to the irregular forms of malaria supposed to be peculiar to New York, an irregularity in the fever caused by the tertian parasite does seem to be more common in this latitude than farther south,

although the essential features presented by such cases are the same here as elsewhere. Thus, 6 cases of our 30 double tertian infections were examples of this class, whereas in 116 cases of double tertian infection reported in Baltimore by Thayer and Hewetson, only 3 showed any marked irregularity in the temperature curve.

Most of the cases of irregular fever of this type observed here seem to have been instances of double tertian infection in which inefficient administration of quinine, or conditions of climate and surroundings, caused a partial destruction of the organisms present in the blood and a derangement of their usual regular grouping. Development in a less resistant subject of several groups of the parasite at once, as seems to occur in children, may also cause irregularity in the paroxysms, with a tendency to a continuous type of fever.

As to the effect of our latitude in producing this irregularity, it may be that the tertian organism having to contend with more unfavorable conditions outside the body, develops here a greater resistance than in more southern climates, and is therefore more tenacious when established in the blood. In favor of this view may be adduced the following considerations :

1. The duration of the paroxysms caused by the tertian parasite here averages sixteen hours, as against an average of eleven hours in Baltimore.

2. The attempt to convert a quotidian into a tertian attack by destroying one group of organisms with a single moderate dose of quinine, as successfully practised by Thayer and Hewetson in Baltimore, was with us either completely ineffectual, or resulted in the production of an irregular daily rise of temperature.

3. The same tendency toward irregularity was noticed when a double infection showed spontaneous subsidence, in which case an irregular quotidian fever would frequently persist for six or seven days, when quinine would be given to terminate the attack. This again is contrary to the experience of Thayer and Hewetson in Baltimore, who found that in such cases either one group of organisms would disappear, leaving the other in possession to cause tertian paroxysms, or both groups would promptly vanish after two or three abortive paroxysms.

As to the cases of "fever with long intervals," these may apparently be produced by the administration of a single moderate dose of quinine at each paroxysm, or without medication by spontaneous

destruction of the greater number of organisms during pyrexia, followed by a new incubation of the remainder of the group.

The æstivo-autumnal cases are everywhere markedly irregular in the febrile manifestations—New York being no exception to this rule. Yet an analysis of the temperature curves of the two cases observed by us, shows them to correspond quite strikingly to the “æstival-tertian” type of fever first distinguished by Marchiafava and Bignami.

As the organisms in these severer infections are often very scanty in the peripheral circulation, and as frequently only the very small hyaline bodies are to be found after careful search, it is probable that some cases which are considered “malarial fever without organisms” in New York are æstivo-autumnal infections in which the parasite has been overlooked. Cases in which no organisms are ever found by competent observers, we are not justified in classifying as malarial.

The fact that so few cases of æstivo-autumnal fever occur here, in the presence of so considerable a number of tertian infections, would seem to us to indicate that the æstivo-autumnal parasite, though more virulent than the tertian organism, is more vulnerable outside the body when exposed to unfavorable climatic conditions.

No cases of Malarial Cachexia, so called, were observed in our series.*

Treatment of New York Malaria.

A word or two under this head seems called for here on account of the disrepute into which quinine alone as an antiperiodic has fallen in the estimation of some, at least, of the practitioners in this city. It is not infrequently stated that Warburg's tincture is our only trustworthy agent in dealing with New York malaria.

With us, quinine in solution was invariably effectual in the tertian infections when given in sufficient doses at the proper time (gr. vj.-x.-xx. at the paroxysm), care being taken to continue its use in smaller doses (gr. iij.-v.) three times a day for at least two weeks. In the æstivo-autumnal cases moderate doses repeated at intervals of a few hours (gr. v. q. 4 h., or gr. x., t.i.d.) promptly controlled the symptoms, and caused the disappearance of all organisms.

* See Laveran's¹¹ recent articles on this subject.

When quinine is not well borne, a single full dose at the paroxysm, repeated once a week for a month, will be effectual with a minimum of discomfort.

Warburg's tincture was not used by us.

Accurate therapeusis would seem to be especially important in this climate on account of the tendency of tertian fever here to assume an irregular type if not effectually controlled. If exhibited when the organism is most vulnerable, at or just before the segmenting stage, we believe that quinine alone in appropriate doses will be found to merit, on Manhattan Island, the confidence which is reposed in it all over the world.

BIBLIOGRAPHY.*

1. LAVERAN : "Du Paludisme." Paris, 1892. (*Encyclopédie scientifique des aide-mémoire.*)
2. MANNABERG : Die Malariaparasiten. Wien, 1893. Also (Trans.), The New Sydenham Society, Vol. CL. London, 1894.
3. THAYER AND HEWETSON : The Malarial Fevers of Baltimore. The Johns Hopkins Hospital Reports, Vol. V., 1895.
4. FRIEDRICH PLEHN : Ueber das Schwarzwasserfieber an der Afrikanischen West-Küste. Deutsch. Med. Woch., Nos. 25, 26, 27, 1895.
5. FISCH : Das Schwarzwasserfieber nach den Beobachtungen und Erfahrungen auf der Goldküste Westafrikas. Deutsch. Med. Zeit., Nos. 20, 22, 1896.
6. LAVERAN : *Geographie Médicale du Paludisme.* Janus (Amsterdam), Vol. I., pp. 301, 397, 1896-97.
7. WELCH AND THAYER : Article on "Malaria" in Loomis-Thompson's American System of Practical Medicine, Vol. I., 1897.
8. THIN : The Parasite of Malaria and Malarial Fevers. *Lancet*, July 6, 1895.
9. BUCHANAN : Specimens of the Hæmatozoa of Malaria. Transactions, Glasgow Clin. & Path. Soc., Vol. V., p. 19.
10. RUST : A Case of Phthisis Complicated by Malaria. *British Medical Journal*, Vol. I., p. 1385, 1896.
11. ZIEMANN : Zur Morphologie der Malariaparasiten. *Centralblatt für Bakt.*, Vol. XXI., p. 641, 1897.
12. DANILEWSKY : Zur Kenntniss der Malariamikroben Menschen. *Centralbl. f. Bakt.*, Vol. XVIII., p. 225, 1895. Also, *Zur Lehre von der Malaria-Infektion bei Menschen und Vögeln.* *Archiv für Hygiene*, Vol. XXV., p. 227

* This list includes the authorities utilized in the preparation of this article, together with such references dealing with the parasitology of malaria since 1895 as were accessible to us. The literature previous to that time may be found in the works of Laveran, Mannaberg, and Thayer and Hewetson, referred to above.

13. SACHAROFF : Ueber die selbständige Bewegung der Chromosomen bei Malariaparasiten. *Centralbl. f. Bakt.*, Vol. XVIII., p. 374, 1895. Also, Ueber den Entstehungsmodus der verschiedenen Varietäten der Malariaparasiten der unregelmässigen s. *Æstivo-autumnalen* Fieber. *Centralbl. f. Bakt.*, Vol. XIX., p. 268, 1896. Also, Die Malariaparasiten der Hämato-blasten und die Anwendung der Morphologie dieser Parasiten zur Entscheidung einiger Probleme der Blut- und Pigmentbildung. *Centralbl. f. Bakt.*, Vol. XX., p. 12, 1896.
14. LEWKOWICZ : Ueber den Entwicklungsgang und die Einteilung der Malariaparasiten. *Centralbl. f. Bakt.*, Vol. XXI., p. 129, 1897.
15. KIRIKOFF : Zur Morphologie der Malariaparasiten. *St. Petersb. Med. Woch.*, N. F. XIV., p. 397, 1897.
16. JANCsó & ROSENBERGER : Blutuntersuchung der in Jahre 1894 vorgekommenen Malariafälle mit besondere Berücksichtigung der Specificität der verschiedenen Malariaparasiten. *Deutsch. Arch. f. Klin. Med.*, Vol. 57, p. 449.
17. BACELLI : (a) La Malaria. *Il Polikliniko*, Vol. III. (Medical), p. 205, Roma, 1896. Also, (b) Della Emoglobinuria da Malaria. *Il Poliklinko*, Vol. IV., (med.) p. 1, 1897. Also, Emoglobinuria da Malaria. *Gaz. degli Ospedalia*, Vol. XVIII., p. 193, 1897.
18. BOISSON : Hæmatozaire de l'Impaludisme. *Lyon Médicale*, Vol. LXXXII., p. 48, 1896.
19. MARSHALL AND THIN : The Parasite of Malaria with Special Reference to the Malarial Fevers of the South of Spain. *Medico-Chirurg. Trans.*, Vol. LXXIX., p. 101. London, 1896. Also, *British Medical Journal*, Vol. I., p. 403, 1896.
20. LAVERAN : De l'hæmatozaire du Paludisme. *La Semaine Médicale*, May 9, 1896. Also, *Comptes rend. des Séances de l'Acad. d. Sciences*, Vol. CXXII., p. 977, 1896.
21. BILLET : Sur les hæmatozoaires des Ophidiens du Haut Tonquin. *Comptes rend. d. l. Soc. d. Biol.* 10 s., Vol. II., p. 29.
22. MAYNARD : Notes on the Examination of Malarial Blood. *Indian Medical Gazette*, Vol. XXX., p. 412, 1896.
23. MCNAUGHT : Observations on the Parasites of Malarial Fevers. *Indian Medical Gazette*, Vol. XXX., p. 473, 1895. Also, On the Examination of the Blood in Malarial Fever. *British Medical Journal*, Vol. II., p. 841, 1896.
24. ROSS : Some Practical Points respecting the Malarial Parasite. *Indian Medical Gazette*, Vol. XXXI., p. 42. Also, Observations on Malarial Parasites. *British Medical Journal*, Vol. I., p. 260, 1896. Also, A Condition Necessary to the Transformation of the Malarial Crescent. *British Medical Journal*, Vol. I., p. 251, 1897. Also, Pigmented Cells in Mosquitoes fed on Malarial Parasites. *British Medical Journal*, Vol. II., p. 1786, 1897.
25. MANSON : Benign and Pernicious Malarial Fevers. *British Medical Journal*, Vol. I., p. 257, 1896. Also, The Life History of the Malaria Germs Outside the Human Body. *British Medical Journal*, Vol. I., pp. 641, 712, 774, 1896. Also, A Method of Staining the Malaria Flagellated Organism. *British Medical Journal*, Vol. II., p. 68. 1897.

26. LAVERAN : Comment prend-on le Paludisme ? *Revue d'Hygiene*, Vol. XVIII., p. 1049, 1896.
27. BIGNAMI : Hypotheses as to the Life History of the Malarial Parasite Outside the Human Body. *Lancet*, Vol. II., pp. 1363, 1441, 1896.
28. ROGERS : The *Ætiology of Malarial Fever*, with Special Reference to the Ground, Water-level, and the Parasite. *Indian Medical Gazette*, Vol. XXXI., p. 49, 1896.
29. WALSH : The Parasite of Malaria. *Indian Medical Gazette*, Vol. XXXI., p. 433, and Vol. XXXII., p. 81, 1896-97.
30. HEHIR : The *Hæmatozoan of Malaria* and its Discovery in Water and Soil. *Lancet*, Vol. II., pp. 1514, 1589, 1896. See also Ross, "Surg. Capt. Hehir and the Parasite of Malaria." *Lancet*, Vol. I., p. 551, 1897.
31. VAN DER SCHEER : Ueber Tropische Malaria. *Virchow's Archiv*, Vol. CXXXIX., p. 80.
32. STEUDEL : Zur Chininbehandlung des Schwarzwasserfiebers. *Deut. Med. Woch.*, No. 40, 1895.
33. DOERING : Zur Kenntniss des Schwarzwasserfiebers. *Deutsch. Med. Woch.*, Vol. XXI., p. 761.
34. ZIEMANN : Ueber Blutparasiten bei heimischer und tropischer Malaria. *Centralbl. f. Bakt.*, Vol. XX., p. 653, 1896.
35. ALBERT PLEHN : Beiträge zur Kenntniss von Verlauf und Behandlung der tropischen Malaria in Kamerun. Berlin, 1896.
36. ANTONY : (Fièvre bilieuse hæmaturique). *Journal de Méd. de Bordeaux*, Vol. XXVII., p. 235, 1897.
37. CARMOUZE : Le fièvre bilieuse hæmaturique au Soudan. *Archiv. de Méd. Navale*, Vol. LXVII., p. 337.
38. MARCHAUX : Le Paludisme au Senegal. *Arch. de Méd. Navale*, Vol. LXVIII., p. 288, 1897. Also, *Annales de l'Institut Pasteur*, Vol. XI., p. 640, 1897. Also, *Comptes rend. d. l. Soc. d. Biologie*, Vol. IV., p. 752, 1897.
39. MOORE : Malarial *Hæmatozoon* in Ashanti Fever. *Lancet*, Vol. I., p. 1285, May 9, 1896.
40. DUGGAN : Parasites of the Malarial Fevers at Sierra Leone. *Lancet*, Vol. I., p. 881, March 27, 1897.
41. THIN : Pathology of Pernicious Malarial Fevers of Sierra Leone. *Brit. Med. Jour.*, Vol. II., p. 1262, 1897.
42. BOISSON : Commun. à la Soc. de Méd. de Lyon, March 16, 1896. [Quoted by Laveran.^o]
43. KAUFMANN : Krankheiten Aegyptens. *Atti del XI. Congresso Medico Internazionale*, Vol. II., p. 210. Roma, 1894.
44. SMITH : On Malaria in Central Africa. *Liverpool Med.-Chir. Jour.*, Vol. XVII., p. 422, 1897.
45. DOMINICI : *Gaceta Medica de Caracas*, Vol. IV., p. 145, 1896, also Vol. V., p. 9, 1897. [Not accessible. Quoted by Laveran.^o]
46. AVILA ECHEVERRIA : Le Paludisme en Guatemala. Thèse, Guatemala, 1895. [Not accessible. Quoted by Laveran.^o]

47. DANIELS : The Malaria Parasite in British Guiana. British Medical Journal, Vol. II., p. 1062, October 26, 1895.
 OZZARD : The Malarial Parasite (in British Guiana). British Medical Journal, Vol. II., p. 1637, December 28, 1896.
48. FAJARDO : O Microbio de Malaria. Rio Janeiro, 1893. Annales da Academia de Medicina, 6th Serie, Nos. 3 and 4. [Not accessible. Quoted by Laveran.*]
49. LEON : Contribucion al Estudio del Paludismo en el Peru. La Cronica Medica, Vol. XIV., p. 254. Lima, 1897. Also, Same Journal, Vol. XIV., pp. 25, 59, 71, 1897. "Las fiebres Autumnales." [Not accessible.]
50. E. CANTON : El hæmatozario del Paludismo. Annales du Circ. Med. Argentin. Buenos Ayres, 1892. [Not accessible. Quoted by Laveran.*]
51. CORONADO ; "Laverania linhémica" (translated). Pacific Medical Journal, Vol. XXXVIII., p. 373, 1895.
52. MATIENZO : Existe el hæmatozario de Laveran en la sangre de los paludicos que se observan in Tampico ? Gaceta Medica Mexico, Vol. XXVII., pp. 424, 441. Also (translated), New Orleans Medical and Surgical Journal, Vol. XX., p. 198, 1892.
53. FRENCH : The Malarial Organism. New York Medical Journal, Vol. LXIII., p. 674. Also, Malarial Fevers in the District of Columbia. New York Medical Journal, Vol. LXV., p. 552, 1897.
54. HARRIS : Malarial Hæmoglobinuria in Southern United States. Alabama Medical and Surgical Age, Vol. IX., p. 548, 1897.
 "Quinine a Harmful Remedy in Malarial Hæmaturia. Editorial, Journal of the American Medical Association, Vol. XXVIII., p. 1039, 1897.
 COLOMB : New Orleans Medical and Surgical Journal, Vol. L., p. 121, 1897.
 BANKSTON : Alabama Medical and Surgical Age, Vol. IX., p. 619, 1896-97.
 MARTIN : Memphis Medical Monthly, Vol. XVI., p. 1.
 WOLDERT : A Case of Malarial Hæmaturia with a Study of the Plasmodium. New York Medical Journal, Vol. LXI., p. 229. Also, A Case of Malarial Hæmatnuria, with a Study of the Plasmodium. New York Medical Journal, Vol. LXIII. p. 1, January 4, 1896.
55. WHITEHEAD : The Microscope in the Diagnosis of Malaria. Charlotte Medical Journal, Vol. XI., p. 18, 1897.
56. WHITING : Malaria. Journal of the American Medical Association, Vol. XXVII., pp. 117, 205, 264, 328.
57. MARCHIAFAVA AND BIGNAMI : The Æstivo-Autumnal Fevers. Translation. The New Sydenham Society, Vol. CL. London, 1894.
58. BURLEIGH : The Crescents in Malarial Fevers. Mod. Med. and Bact. Rev., Vol. IV., p. 293, 1895.
59. PREBBLE : Plasmodium Malariae as Found in Chicago. Chicago Medical Recorder, Vol. XI., p. 301.



DESCRIPTION OF THE PLATE.

The drawings were made directly from fresh specimens taken at definite periods in the life-cycle of the tertian parasite, and represent the degree of development at those times. The groups of red cells indicate different appearances presented by organisms of the same age.

I. The hyaline bodies: Group 1, examples of the forms seen one hour after the chill; the lower row represents the changes occurring in these bodies an hour or more after taking the specimen; group 2, form seen at two hours; group 3, at four hours, and group 4, at six hours after the chill.

II. The very young, pigmented bodies: Group 1, examples of the appearances at seven hours; group 2, at eight hours; group 3, at sixteen hours.

III. The half-grown bodies: The forms in group 1 occurred at eighteen hours; in group 2 at twenty-two hours; in group 3 at twenty-four hours. The two forms under 4 occurred at twenty-six hours. The lower one represents an organism which has escaped from the red cell—the shadowy outline of the latter being still visible. The two bodies under 5 were seen at twenty-eight hours, the one under 6 at thirty hours.

IV. Examples of nearly mature forms observed at thirty-two, thirty-four, and thirty-seven hours, respectively.

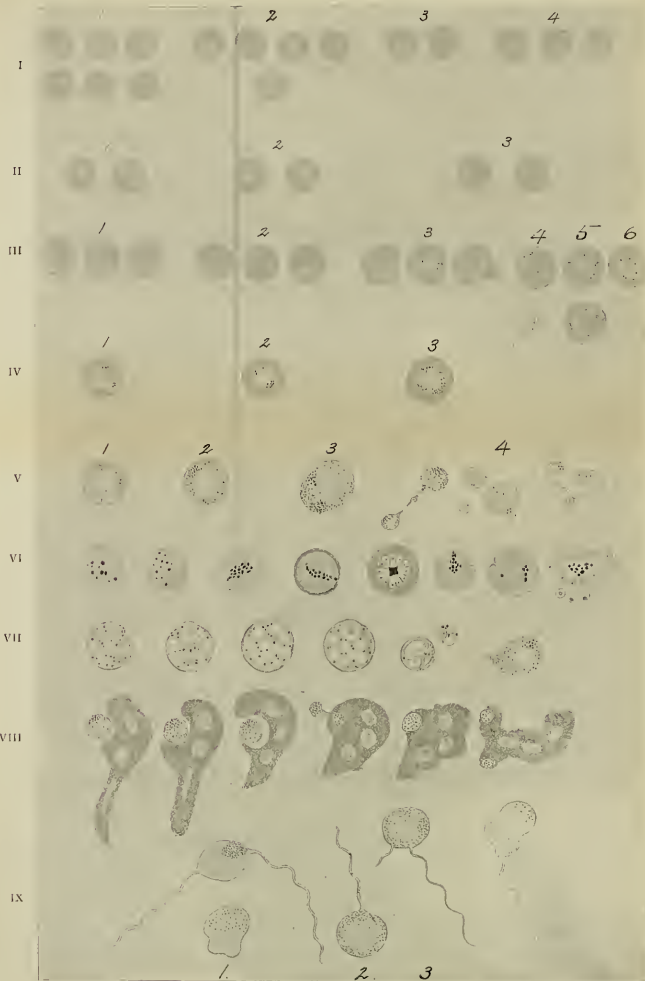
V. 1, 2, and 3, full-grown bodies seen forty, forty-six, and forty-eight hours, respectively, after the chill. Group 4 represents three fragmenting forms.

VI. Segmenting bodies at time of paroxysm.

VII. Vacuolation.

VIII. Phagocytosis.

IX. Flagellate bodies. In 1 and 2 the flagella were ultimately absorbed into the bodies. The figure below the first flagellated form shows the appearance after the entrance of the two flagella. The short flagellum in 3 developed from the body and grew longer while under observation. Both flagella finally broke away from this body.



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The figure below the first flagellated form shows the appearance after the entrance of the flagella. The short flagellum in 3 developed from the body and grew longer than usual observation. Each flagella finally broke away from this body.



60. LEONARD : A Demonstration of the Endogenous Formation of the Malarial Parasite. *International Medical Magazine*, Vol. IV., p. 265. Philadelphia.
61. JACKSON : The Diagnostic Value of an Examination of the Blood. *Boston Medical and Surgical Journal*, Vol. CXXXVI., p. 633.
WINSLOW : A Case of Congenital Malaria. *Boston Medical and Surgical Journal*, Vol. CXXXVI., p. 514.
62. WINFIELD : Blood Examinations Regarding the Malarial Origin of Zoster. *New York Medical Journal*, Vol. LXI., p. 429, 1895.
63. CRAIG : The Parasite of Malaria. *Brooklyn Medical Journal*, Vol. X., p. 231, 1896.
64. SHEFFIELD : (Malaria in Children). *New York Medical Journal*, Vol. LXVI., p. 560, 1897.
65. OSLER : The Practical Value of Laveran's Discovery. *Medical News*, Vol. LXVII., p. 561, 1895. Also, The Diagnosis of Malarial Fever. *Medical News*, March 6, Vol. LXX., p. 289, 1897.
66. THAYER : "Lectures on Malarial Fever." 1897.
67. MARCHIAFAVA AND CELLI : Weitere Untersuchungen über die Malariainfection. *Fortschritte der Medicin*, Bd. III., No. 24, p. 788, 1885.
68. MACCALLUM : On the Hæmatozoan Infections of Birds. *Johns Hopkins Bulletin*. November, 1897. Also, *Lancet*, November 13, 1897.
69. DANILEWSKY : La parasitologie comparée du sang. *Kharkov*, 1889.
70. BIGNAMI : Sulle febbri intermittenti malariche a lunghi intervalli. *Rif. Med.*, No. 165, part 3, p. 169, 1891.
71. LAVERAN : Des fièvres palustres larves. *Rev. Gén. de Clinique et de Thérap.*, Vol. XI., p. 481, 1897. Also, *Compt. rend. de la Soc. de Biol.*, Vol. IV., p. 443, 1897.
72. LAWRIE : "The Cause of Malaria." *British Medical Journal*, Vol. I, p. 1135, 1896.
Refutation by Ross. "Surg. Lieut.-Col. Lawrie and the Parasite of Malaria." *Indian Medical Gazette*, Vol. XXXI., p. 353, 1896.

IX.

A REPORT OF CASES OF OPERATION UPON THE GALL-BLADDER AND BILE-DUCTS.

BY CHARLES K. BRIDDON, M.D.

CASE I. *Choledochotomy.*

S. R., aged thirty-five; housewife; Austria. Her previous history showed no evidence of malaria, rheumatism, or syphilis. She was not alcoholic. Menstrual history was good. She had borne seven children, the youngest three months old. Eight months ago she had an attack of pain and was jaundiced.

Her illness for which she was admitted to the hospital began, ten weeks before she was admitted, with severe griping pain in the epigastrium, accompanied by chills, fever, vomiting, sweating, and the appearance of jaundice. The severe pain lasted for three days, and required the administration of opium. This was followed by a dull ache in the upper part of the abdomen, on the right side, which region also became very tender to pressure.

The ache continued up to the time of admission with varying intensity, and she had two exacerbations of very severe pain similar to the original attack. The jaundice remained marked, associated with itching of the skin. She was constipated, and stools were of a gray-color. She was under observation, in the service of Dr. Northrup, in the medical wards of this hospital for one week, and was then transferred to the Surgical Division, with the probable diagnosis of biliary calculi.

On admission to the Surgical Division, on May 4, 1897, a physical examination revealed the following facts: She was thin and poorly nourished, markedly jaundiced. The tongue was coated; the superficial glands were not enlarged. The heart was forcible and regular, with a slight systolic murmur at the apex not transmitted. The lungs were normal. The abdomen was soft, not distended; there was moderate tenderness on deep palpation in the epigastric and

right hypochondriac regions. The liver percussed from the fourth space to the free costal margin, where the note became markedly tympanitic. The edge was felt one and one-half inches below the costal margin in the mammary line. Spleen percussed normal, not felt. No distinct masses felt in abdomen, but at times it was thought that a small mass could be indistinctly felt in the region of the gall-bladder. The urine contained a trace of bile-pigment, but was otherwise normal. Temperature, 98.8° F.; pulse, 96.

On the following day, May 5, under ether, an incision was made parallel to, and one inch below, the costal margin, five inches in length, with its centre opposite the junction of the eighth and ninth costal cartilages, thus opening the abdominal cavity. The great omentum was found adherent to the under-border of the liver at the fissure for the gall-bladder, and after careful ligation and division of the above adhesions, the stomach with the first portion of the duodenum were found approximated to the under-surface of the liver, the gastro-hepatic omentum being very materially shortened. The gall-bladder exposed was small and normal in color, and through its wall could be felt hardened masses, movable on each other with smooth crepitus, entirely filling its cavity. Below and to the inner side, just above the duodenum, there was felt an additional hard, rounded body, quite freely movable upward toward the liver. Palpation dislodged this body upward beyond the reach of the finger. By manipulation it was made to resume its former position, and was subsequently extracted.

The gall-bladder being drawn upward by a tenaculum, and the adjacent portion of the peritoneal cavity being carefully protected by pads, a longitudinal incision, one and one-half inches in length, was made through its wall, which was of normal consistence, but increased in thickness. Through this orifice a large number of calculi were extracted, varying in size from a millet-seed to a large-sized marble, the larger ones having faceted surfaces, and of striated appearance. There escaped also a considerable amount of fluid bile, which was carefully caught and removed by sponges. After being thoroughly emptied, the cavity of the gall-bladder was temporarily packed with a sponge, attention being directed to the hard body previously mentioned between the layers of the gastro-hepatic omentum.

A longitudinal incision was made over the body parallel to the

line of the duct, and a calculus the size of a marble removed from the common duct. Some bile also escaped from the orifice. The finger introduced into the duct, down toward the duodenum, distinctly felt the circular opening of the duct in the lumen of the gut. A soft rubber catheter was also passed into the duodenum as far as its third portion. The opening into the duct was then closed with a continuous Lembert suture of catgut, and the gall-bladder incision was closed in a similar manner.

The incision in the abdominal wall was closed by interrupted silk-worm-gut sutures after the introduction of two small wicks of iodoform gauze, one to the line of the suture of the duct, the other to the similar line of suture in the gall-bladder. Copious dressing was applied, and the patient left the table in perfectly good condition, her pulse being 76.

Convalescence was uneventful. The pulse was never above 96, and the temperature, 101° F., for two days, fell to normal on the third day after moving the bowels with small repeated doses of calomel and a saline.

The stools, at first of a clay-color, gradually regained their normal appearance, and, coincident with this, the urine lost its bile-pigment and the skin regained its normal hue; the latter, however, followed very slowly. For a week there was some escape of bile from the wound. At the end of this time this ceased and the wound entirely closed.

She was out of bed on May 29, and discharged in good health on June 1.

CASE 2. *Cholecystotomy.*

A. E., aged forty-six; housewife; Germany. The patient had always enjoyed good health, excepting for a slight tendency to rheumatism, until six days before her admission to the hospital. That evening, after having eaten a meal consisting largely of "pumpernickel," she began to have attacks of pain, cramp-like in character, situated just below the ensiform cartilage in the epigastric region. These pains continued during the night and were accompanied by frequent vomiting of a bilious character. On the following day, the cramps and vomiting having subsided, she was up and out of bed, but she suffered from a continuous pain in the right iliac region, where the abdomen was also tender; this continued up to

the date of her admission, November 16, 1896. She has had no chills and her bowels have moved once a day, and the day before admission, with the aid of a cathartic, she expelled a large amount of gas. Her appetite was good. She had not lost any flesh or strength.

On admission a careful physical examination revealed the following facts: She was thin, poorly nourished, and somewhat anæmic. The thoracic viscera were normal. The inguinal glands of the right side were palpable; other superficial glands were not enlarged. Liver dulness was made out by percussion to extend from the fifth intercostal space to the free costal margin in the mammary line; a satisfactory attempt to feel the lower margin could not be made on account of the abdominal distention and tenderness. The spleen percussed normal but could not be felt. The abdomen was distended, prominent, and tympanitic all over. There was extreme tenderness over the right side, preventing satisfactory palpation.

She was at once anæsthetized with the purpose of making a more thorough examination of the abdomen. On the right side of the abdomen there was felt an elongated mass beginning in the region of McBurney's point; it was about two and one-half inches in breadth and ran up to the edge of the liver, and then apparently inward for a distance of an inch toward the median line. It was hard, roughened slightly, freely movable under the abdominal wall, and apparently lay in front of the kidney. The urine which was passed after the administration of the ether contained forty per cent. of albumin and many casts, no pus or blood.

An absolute diagnosis was not made, and the patient was put to bed for further observation. She was carefully questioned in regard to jaundice and clay-colored stools, and although very intelligent, could not recall any such symptoms.

Her bowels moved freely on the following day after oleum ricini; the stools were normal in color and contained neither blood nor mucus.

On November 18 her abdominal distention had progressively increased, and tenderness all over the right abdomen was exquisite. Her temperature had steadily risen to 102° F., with no fall; her pulse was 108, and respiration 24. It was deemed best to make an explorative operation at once, and she was etherized for that purpose. The abdomen was opened by an incision six inches in length in the right semilunar line, beginning above at the liver's edge. The omen-

tum was found firmly adherent to the parietal peritoneum, and when these adhesions were broken through, there was disclosed a space formed by omentum firmly adherent to the surrounding gut laterally and below, in which lay the lower edge of the liver (normal in size and appearance), and below it a much distended gall-bladder projecting downward, forward, and inward, to a transverse line drawn through the umbilicus, its wall dark in color, thickened, and covered with recent adhesions. The general peritoneal cavity, which had been necessarily opened in the manipulation of the gall-bladder, was carefully protected with gauze-pads, and a trochar and cannula were passed into the gall-bladder, allowing the escape of several ounces of thick, viscid, bile-stained fluid streaked with pus. The cannula was withdrawn and an incision, two inches in length, made in the anterior wall of the gall-bladder in the line of the incision in the abdominal wall. The wall was one-third of an inch in thickness, friable, and through the opening there escaped a large number (75-100) of small blackish calculi, varying in size from that of the head of a pin to a small pea, and two larger calculi, each of which was faceted and the size of a large marble. The gall-bladder having been thoroughly cleaned out with sponges, a thorough search failed to reveal any calculi in the cystic or common ducts. This examination was somewhat impeded by the fact that the gastro-hepatic omentum was very short, and owing to the presence of adhesions, the examining finger could not be introduced into the foramen of Winslow. The first and second portions of the duodenum were covered also with recent adhesions.

The wall of the gall-bladder was now sutured to the edges of the parietal peritoneum with interrupted sutures of catgut and silk, thus leaving free drainage for the gall-bladder. The abdominal wall below the fistulous opening thus formed was approximated with silk-worm-gut, space being left for a wick of iodoform gauze, which permitted of drainage from this pocket. Drainage for the gall-bladder was obtained by means of two quarter-inch rubber tubes which protruded from the fistulous opening.

The patient practically sustained no shock from the operation, and suffered almost no pain. Recovery was practically uneventful. Feeding was commenced with fluids on the day after the operation and gradual additions made to the diet until on the tenth day she was given a full house-diet. The abdominal wound below the

fistulous opening healed readily by granulation ; the fistulous opening continued to discharge bile, ever diminishing in amount until, on the day of her discharge, six weeks after the operation, it admitted only the point of the scissors, and the bile discharged was estimated at about one ounce a day.

Dr. Thacher having made a culture from the gall-bladder fluid obtained during the operation, reported a pure growth of *staphylococcus pyogenes aureus*.

During convalescence no abnormality in the stools occurred either in amount, consistence, or color.

X.

ONE YEAR'S EXPERIENCE WITH THE WIDAL TEST FOR TYPHOID FEVER.

BY GEORGE A. TUTTLE, M.D.

THE Widal test for typhoid fever has been so widely practised and discussed that it needs no description. Its uses and its limitations also have been well defined. The hope, at first aroused, that a reliable aid to the early diagnosis of typhoid fever had been discovered, has not been fully realized. Experience has shown that the peculiar property in the blood upon which this test depends is developed with great irregularity in point of time and strength in different cases of the disease. The period in the disease at which the reaction is obtained varies between wide limits, and in a small percentage of cases of undoubted typhoid fever it is not obtained at all. It often happens that the diagnosis is made from the clinical symptoms long before the reaction can be obtained, and the test is merely confirmatory. On the other hand, the reaction is sometimes obtained in diseases other than typhoid fever, and when there is no history of a previous attack of this disease. The exceptions on both sides, however, form but a very small percentage of the cases examined, and it is probable that with greater knowledge and experience, and more careful observation, most of these errors will be eliminated. When the reaction is promptly and strongly developed, a tyro in the use of the microscope can readily recognize it. But in slight, or tardy, or doubtful, reactions much practical experience and judgment are required to arrive at an opinion as to the probabilities of the case.

The method of procedure at the Presbyterian Hospital, with but few exceptions, has been to examine a drop of blood dried upon a slide. The blood is dissolved in from ten to fifteen volumes of water

(estimated). A small drop of this solution is placed upon a cover-glass, and an almost equal volume of a pure culture of typhoid bacilli in bouillon is added, and the preparation is then examined as a hanging drop. The cultures used in these tests are grown for from eighteen to twenty-four hours at a temperature somewhat above that of the room, but less than blood-heat. They are also previously examined under the microscope as to the motility and freedom from clustering of the bacilli. If at the end of fifteen minutes the bacilli in the preparation are still actively motile, another preparation is made with a stronger solution of blood. In the following table of cases examined, the terms slight, fair, good, and strong are used to describe the reactions obtained. When, in using the ordinary dilution of the blood (about 1-15), the bacilli instantly become motionless without forming groups, and in some cases appear to be irregular in shape and somewhat disorganized, the reaction is called strong. In these instances a much greater dilution of the blood produces the characteristic loss of motility, with clustering of the bacilli. If in a dilution of 1-15 the reaction is completed within five to ten minutes, it is called good. If at the end of fifteen minutes the motility of the bacilli is not completely lost, but a small number are still active between the groups, it is called a fair reaction. And, finally, when there is only moderate grouping and partial loss of motility at the end of fifteen minutes, and a stronger solution of blood intensifies these changes, it is considered a slight reaction, and may or may not indicate typhoid fever.

During the past year the test has been pretty widely applied in the Presbyterian Hospital, with a view to determining its reliability and value, and the results obtained in different diseases are tabulated at length on page 162 and following pages.

Of the 211 cases tabulated, 100 were clinically not typhoid fever; 106 were clinically typhoid fever, and were examined during or immediately after the febrile stage; and five were cases with a history of typhoid fever at some previous time within twenty-one months. On account of the difficulty in determining the exact day of the disease in typhoid fever in hospital cases, some allowance must be made in the figures of the results; but great care has been exercised to make them as accurate as possible. The earliest day on which the reaction has been obtained is the fourth day in four cases.

No.	Name.	Sex.	Date of Examination.	Day of Disease.	Reaction.	Days in Hosp.	Clinical Diagnosis.	Remarks.
1	Ahearn	F.	Nov. 22, '97		None		Pyelonephritis.	
2	Ahrendorf	M.	Oct. 8, '97	10th	Good	49	Typhoid fever; relapse.	Headache, malaise, epistaxis; apathy, constipation; spleen a little increased in size; no eruption; temperature, 101-3° F., for about two weeks, then gradually declined to normal at end of third week.
3	Bailey	F.	June 16, '97		None		Typhoid fever	Died; no autopsy.
	"	"	June 28, '97		None			
	"	"	July 10, '97		None			
4	Bamberger	M.	Sept. 23, '97	7th	Fair	19	Typhoid fever; pneumonia	
5	Barveld	M.	April 9, '97		None		Suppurative mastoiditis; cerebral abscess.	
6	Becker	F.	July 6, '97		None		Chronic endocarditis, purpura hemorrhagica.	
7	Beekman	M.	Aug. 6, '97	10th	Good	6	Typhoid fever; peritonitis; bronchio-pneumonia.	Died; autopsy; intestinal ulceration marked; some ulcers almost perforating; peritonitis; bronchio-pneumonia; typhoid bacilli obtained by culture from the spleen.
8	Behrens	F.	July 1, '97		None		Tuberculosis of kidney.	
9	Berlund	F.	Feb. 22, '97		Good		Appendicitis; general peritonitis.	Died on the sixth day in hospital, with temperature of 109° F.; autopsy; no history of typhoid fever.
10	Beresford	M.	Nov. 5, '96	19th	Good	46	Typhoid fever.	
11	Blondale	F.	Nov. 20, '96		Strong		Intestinal hemorrhage.	
12	Blue	F.	Dec. 30, '96		None		Pleurisy with effusion.	
13	Borke	F.	Jan. 5, '97		Fair	57	Typhoid fever; relapse.	
	"	M.	Nov. 9, '96	7th	None		Chronic nephritis; chronic endocarditis; uræmia.	
14	Bradley	M.	Nov. 7, '96		None		Typhoid fever.	
	"	"	Nov. 6, '97	6th	None			
	"	"	Nov. 9, '97	9th	None			
15	Brennan	M.	Nov. 23, '97	23d	Good	46		
16	Brinkerhoff	M.	Nov. 13, '97	6th	Good		Typhoid fever	Still in hospital.
	"	"	Jan. 7, '97		Good		Typhoid fever; relapse	Ill four weeks with typhoid symptoms; then well three weeks; now in second week of relapse; temperature, 101-5° F.; diarrhoea; large spleen, etc.
17	Brophy	M.	July 14, '97		None	34	Typhoid fever.	
	"	"	July 16, '97	10th	Fair			
	"	"	July 30, '97	24th	Strong			
18	Brown	F.	Nov. 28, '97		None		Appendicitis.	
19	Brown	M.	Nov. 22, '97		None		Abscess of liver; ulcerative colitis.	Died; autopsy.
20	Brush	M.	Feb. 11, '97		None		La grippe.	
21	Burke	M.	Nov. 22, '97		None		Chronic nephritis; alcoholism; poisoning by gas.	Died; autopsy.
	"	"	Nov. 6, '96		None		Perforating ulcer of stomach.	
22	Burke	F.	Nov. 17, '96	4th	Good		Typhoid fever.	
23	Butner	M.	Nov. 27, '97	14th	Fair	42		Still in hospital.
24	Butzel	M.	Nov. 27, '97	19th	Good			Plasmodia found.
25	Byrnes	M.	Nov. 6, '96		None		Malaria	
26	Christensen	M.	Nov. 7, '96		None		La grippe; dry pleurisy.	
27	Cohen	M.	Jan. 9, '97		None		Chronic nephritis.	
28	Conlin	F.	May 25, '97	8th	Good	71	Typhoid fever; peripheral neuritis.	
29	Conlin	M.	May 25, '97		None		Meningitis.	
30	Conlin	M.	May 25, '97		None		La grippe.	

31	Calman	M.	Sept. 20, '97	.....	None	.....	Tuberculosis of lungs.	Continuous temperature for four weeks; for past week temperature about 99.5° F.
32	Conroy	M.	Sept. 25, '97	.....	None	.....	Broncho-pneumonia.	Child 21st; some fever; temperature on admission, 102° F.; it gradually declined to the normal on the ninth day; had some pelvic inflammation with suppuration, and constipation with impaction of faeces previous to this illness.
33	Corbin	F.	July 4, '97	.....	None	.....	Typhoid fever (?)	Patient died on thirty-second day with symptoms of intestinal perforation.
	"	F.	July 7, '97	.....	None	.....	Typhoid fever (?)	
34	Costello	F.	May 15, '97	.....	None	.....	Ephemeral fever; constipation.	
35	Cunningham	M.	Dec. 28, '96	14th	None	.....	Typhoid fever	
	"	M.	Jan. 8, '97	25th	None	.....	Typhoid fever	
36	Cresswell	M.	Jan. 13, '97	30th	None	66	Typhoid fever.	
37	Curran	F.	Oct. 14, '97	11th	Strong	69	Typhoid fever and relapse.	
38	Currie	M.	Nov. '96	4th week	None	.....	Continued fever.	
	"	M.	Oct. 3, '97	.....	None	.....	Septicæmia.	
39	Dewfall	F.	Oct. 14, '97	.....	None	.....	Septicæmia.	
	"	F.	June 23, '97	.....	None	.....	Septicæmia.	
40	Diamond	M.	June 28, '97	.....	None	.....	Tuberculosis of lung; abscess of lung.	
	"	M.	Oct. 13, '97	.....	None	47	Typhoid fever.	
41	Donohue	M.	July 16, '97	12th	Slight	.....	Typhoid fever.	
	"	M.	July 20, '97	16th	Good	.....	Typhoid fever.	
42	Dorrence	F.	July 20, '97	26th	Strong	31	Typhoid fever.	
	"	F.	Dec. 11, '96	.....	Slight	.....	Typhoid fever.	
43	Doyle	M.	Dec. 12, '96	10th	Good	68	Typhoid fever; relapse; femoral phlebitis.	
	"	M.	May 11, '97	15th	Good	.....	Typhoid fever.	
44	Dresser	M.	Jan. 12, '97	12th	Good	43	Typhoid fever.	
45	Dunn	M.	Oct. 27, '96	61st	Good	53	Typhoid fever; relapse.	
46	Dwight	M.	June 2, '97	10th	Good	70	Typhoid fever.	
47	Dwyer	F.	Oct. 20, '97	11th	Good	43	Typhoid fever.	
48	Edwards	M.	July 6, '97	.....	None	.....	Constipation.	
49	Edwards	M.	Nov. 1, '97	Not known; probably 3d week	Good	35	Typhoid fever.	
50	E.	M.	April 23, '97	.....	Fair	.....	Typhoid fever	Typical course one year ago.
51	Einstein	M.	July 30, '97	Very late in disease.	Good	.....	Typhoid fever	Patient died soon after test was made; diagnosis had been malaria; no plasmodia malaria found; clinically typhoid fever.
52	Eldridge	F.	Nov. 5, '96	16th	Good	54	Typhoid fever.	Headache, epistaxis, some chills, diarrhoea, malaise for three weeks before admission; spleen easily palpable; suspicious spots on abdomen and back; some blood in stools for two days—some bright red and some dark; has lost flesh and is apathetic; temperature, 101-4° F., gradually diminishing for eleven days; pulse, 88; respiration, 20; tumor of shoulder the size of a large orange; surface smooth; fairly hard; movable on deeper parts, skin over it movable; not tender; at the end of a week in the hospital the tumor became tender and the skin over it red; it was found to be a suppurating subdeltoid bursitis and was dissected out; the temperature immediately became normal and prompt recovery followed.
53	Fahey	M.	Dec. 28, '96	2 months after illness.	Good	.....	Typhoid fever (?) ; suppurating bursitis (subdeltoid).	

No.	Name.	Sex.	Date of Examination.	Day of Disease.	Reaction.	Days in Hosp.	Clinical Diagnosis.	Remarks.
54	Fahey	M.	Dec. 28, '96.		Good		Chronic Nephritis	Ill in bed four weeks before admission; weakness, dizziness, headache, insomnia; chilly sensations and fever. Temperature, 101-3° F.; sometimes normal in the morning; after three weeks remained normal; spleen not felt; no eruption.
	"		Jan. 1, '97		Good		"	Urine, 1035; very large amount of albumin; few granular casts; no history of typhoid fever.
	"		Jan. 7, '97		Good		"	Re-entered hospital; with strong solution of blood some clustering of bacilli, but active motility between groups; with ordinary solution of 1-10, no grouping.
	"		Oct. 28, '97		None		"	
55	Faulkner	M.	Nov. 23, '97		None		Tuberculosis of lungs.	
56	Fisher	M.	Nov. 17, '97		None		La grippe.	
57	Flinsch	M.	Nov. 19, '97		None		La grippe.	Typical typhoid fever with relapse twenty-one months ago.
58	Friedman	M.	Nov. 2, '96		None		Malaria.	
59	First	F.	July 15, '97	15th (?)	Fair	38	Typhoid fever.	
60	Gibney	M.	Sept. 16, '97	11th	Good	50	Typhoid fever.	
61	Gillespie	M.	Sept. 7, '97		None	62	Typhoid fever.	
	"		Sept. 8, '97		None			
	"		Sept. 14, '97		None			
	"		Sept. 22, '97	3d day of relapse.	Good		Relapse.	
62	Godfrey	M.	Nov. 19, '96	60th	Good		Typhoid fever	Eighth day of normal temperature; one relapse; two hemorrhages.
63	Goldberg	F.	Sept. 13, '97	10th	Good	56	Typhoid fever.	
64	Gottlieb	F.	Jan. 8, '97		None		Catarrhal enteritis.	
65	Greenburg	F.	Dec. 28, '96	15th	Good	55	Typhoid fever.	
66	Gross	M.	July 23, '97	9th	Good	65	Typhoid fever; purpura hemorrhagica.	
67	Halsey	M.	July 30, '97		Good		Typhoid fever.	
68	Hannigan	M.	Oct. 7, '97	12th	Good	44	Chronic Phthisis.	
	"		Nov. 2, '96		None			
	"		Nov. 6, '96		None			
69	Harris	F.	Oct. 2, '97	11th of relapse.	Good	31	Typhoid fever.	
70	Hart	M.	Nov. 5, '96	4th	None		Typhoid fever.	
	"		Nov. 7, '96		None		Relapse.	
	"		Nov. 8, '96		None		Acute lobar pneumonia.	
	"		Feb. 2, '97	7th	Strong			
71	Hartwell	F.	Feb. 14, '97	6th	Fair	50	Typhoid fever.	
72	Hasbrouck	M.	Feb. 19, '97	11th	Good			
	"		Sept. 16, '97	5th	Slight	40	Typhoid fever.	
73	Healy	M.	Sept. 21, '97	10th	Good		Typhoid fever; enteritis.	
74	Hetwig	M.	Sept. 23, '97	4th	Good	46	Lobar pneumonia (double); malaria.	
	"		Nov. 23, '97		None			
75	Henry	M.	Aug. 5, '97	9th	Good	31	Typhoid fever.	Mild course of fever; highest temperature, 103° F.; specimen taken on sixth day of normal temperature.
76	Hewitt	M.	Nov. 7, '96	Not known	Good		Typhoid fever	

77	Heisler	M.	Oct. 22, '97.	None.	.....	Tuberculosis.
78	Heyman.	M.	Sept. 21, '97.	None.	.....	Appendicitis.
79	Hill.	M.	Nov. 12, '96.	None.	.....	Tonsillitis.
80	Hoffer.	M.	Dec. 7, '96.	Strong.	38	Typhoid fever.
81	Hoffner.	M.	Sept. 15, '97.	Strong.	58	Typhoid fever.
82	Holland.	M.	July 1, '97.	None.	.....	Phthisis, subacute.
83	Hughes.	M.	Sept. 29, '97.	None.	.....	Menigitis.
84	Jacobs.	M.	Oct. 4, '97.	None.	.....	Cerebro-spinal.
85	Johnson.	F.	Aug. 16, '97.	None.	.....	La grippe.
						Abscess of thigh.
86	Kaplan.	M.	July 18, '97.	Good.	26	Typhoid fever.
87	Karsch.	M.	Oct. 14, '97.	Good.	36	Typhoid fever.
88	Karston.	M.	July 10, '97.	Good.	34	Typhoid fever.
89	Kaufman.	F.	Aug. 5, '97.	None.	28	Typhoid fever.
	"		Aug. 7, '97.	None.	.....	Relapse.
	"		Aug. 10, '97.	None.	.....	
	"		Aug. 25, '97.	None.	.....	
90	Keen	F.	Nov. 26, '96.	Good.	41	Typhoid fever (?); malaria.
91	Kelly.	M.	April 30, '97.	None.	.....	Pericarditis, acute; endocarditis.
92	Kierman.	M.	Jan. 18, '97.	None.	.....	Phthisis, incipient; cerebral embolism.
93	King	M.	June 4, '97.	None.	64	Typhoid fever.
	"		June 8, '97.	Good.	.....	
94	Kuhlman.	M.	Sept. 13, '97.	None.	31	Typhoid fever.
	"		Sept. 17, '97.	None.	.....	
	"		Sept. 23, '97.	Fair.	.....	
95	Lang	M.	July 28, '97.	Good.	41	Typhoid fever.
	"		Aug. 1, '97.	Good.	.....	
	"		Aug. 9, '97.	Good.	.....	
	"		Aug. 16, '97.	Good.	.....	
96	Larkins.	M.	Nov. 6, '96.	None.	.....	Phthisis.
97	Lavine	F.	Sept. 3, '97.	Good.	10	Typhoid fever.
	"		Sept. 6, '97.	Good.	.....	
	"		Sept. 9, '97.	Good.	.....	
98	Lawrence.	F.	Dec. 15, '96.	None.	.....	Not known.
	"		Dec. 17, '96.	None.	.....	
99	Ledyard.	M.	May 27, '97.	Good.	47	Typhoid fever.
	"		June 2, '97.	Good.	.....	Femoral phlebitis.
100	Leslie	M.	Sept. 22, '97.	None.	.....	Tuberculosis concealed.
	"		Sept. 25, '97.	None.	.....	Dry pleurisy.

Highest temperature, 105.4° F.

Operation for fibromyoma of uterus; followed by tem-
perature with obscure symptoms.
First attack in Mount Sinai Hospital.

Temperature when admitted, 103.8° F., reaching the nor-
mal in the seventh day; spleen palpable; no eruption.
Was ill in bed twenty-four days at home; chill, head-
ache, pain in back, nausea, anorexia; diarrhoea for
two weeks.

Was well for one week, when the same symptoms re-
turned, and she came to the hospital.
Cured, for endometritis with hemorrhage in Oc-
tober; discharged cured. November 13th; returned to
hospital, November 15th, with pain in abdomen, chilly
sensations, and temperature rising from 100-3.5° F. in
six days; spleen palpable; few suspicious spots; on
eighth day temperature fell to normal and remained
so; no plasmodia were found.

Temperature irregular; spleen palpable at first, but soon
disappeared; right kidney much enlarged and tender;
pus and blood in urine; no typhoid eruption.
Typhoid bacilli were found in abundance in the urine

Reacted to tuberculin.

No.	Name.	Sex.	Date of Examination.	Day of Disease.	Reaction.	Days in Hosp.	Clinical Diagnosis.	Remarks.
101	Leslie	M.	Sept. 29, '97.	.....	None.	31	Continued fever	
102	"	"	Oct. 14, '97.	.....	None.			
103	"	"	Oct. 18, '97.	.....	None.			
104	Lindberg	M.	Oct. 26, '97.	.....	None.			
105	"	M.	July 22, '97.	.....	None.			
106	"	M.	July 27, '97.	.....	None.			
107	Lindsay	F.	July 28, '97.	19th	Good.	45	Typhoid fever. Retroperitoneal cancer.	Highest temperature, 101° F.; spleen not enlarged; no eruption; chief symptoms, headache, malaise, and constipation.
108	"	F.	Oct. 27, '96.	.....	None.			
109	"	F.	April 10, '97.	.....	None.			
110	"	F.	April 16, '97.	.....	None.			
111	Linnenhold	M.	April 19, '97.	.....	None.			
112	"	M.	June 26, '97.	.....	None.			
113	Long	M.	June 28, '97.	.....	None.			
114	"	M.	Nov. 14, '96.	.....	Good.			
115	McAllister	M.	Jan. 7, '97.	.....	Good.			
116	"	M.	Nov. 24, '96.	.....	None.			
117	McDonald	F.	Nov. 27, '96.	.....	None.			
118	"	F.	April 6, '97.	.....	None.			
119	"	F.	April 10, '97.	.....	None.			
120	McIntee	F.	April 15, '97.	.....	None.			
121	McNeil	M.	Nov. 21, '96.	20th	Good.	46	Typhoid fever. Malaria.	Illness one year ago.
122	Major	F.	May 25, '97.	.....	None.			
123	"	F.	Dec. 19, '96.	8th	Good.	49	Typhoid fever.	
124	Margaret	F.	Dec. 30, '96.	19th	Good.			
125	Margaretto	F.	Feb. 6, '97.	.....	None.			
126	Maron	M.	Nov. 12, '96.	.....	Good.			
127	Marion	M.	Nov. 22, '97.	10th	Good.	28	Typhoid fever.	Illness two months ago.
128	Maxaker	M.	May 27, '97.	.....	None.			
129	Mayer	F.	.....	.....	None.			
130	Meisner	F.	.....	.....	None.			
131	Martin	M.	Jan. 7, '97.	.....	None.			
132	Maxwell	M.	Dec. 23, '96.	Not known, probably end of second week.	None.			
133	"	"	Dec. 31, '96.	.....	Good.			
134	Meyer	M.	July 30, '97.	3d week	Strong.	4	Typhoid fever.	Still in hospital.
135	Miffler	F.	Dec. 3, '97.	11th	Fair.			
136	"	"	Dec. 4, '97.	12th	Good.			
137	Minly	F.	March 27, '97.	20th	Slight.	64	Typhoid fever and relapse.	
138	"	"	March 30, '97.	32d	Fair.			
139	"	"	April 2, '97.	.....	Fair.			
140	Moore	F.	April 8, '97.	41st	Fair.			
141	Moores	M.	Nov. 22, '97.	22d	Good.	37	Typhoid fever.	
142	"	F.	Oct. 18, '97.	11th	Fair.	39	Typhoid fever.	
143	Moran	F.	Oct. 26, '97.	19th	Good.			
144	"	F.	Jan. 24, '97.	.....	None.			
145	Morse	F.	July 14, '97.	12th	None.			
146	"	"	July 16, '97.	14th	Fair.	56	Constipation. Typhoid fever.	
147	"	"	July 26, '97.	16th	Fair.			

126	Mollan.....	F.	June 1, '97...	None....	.....	Meningitis; cerebral tumor.
127	Munn.....	M.	March 24, '97...	None....	.....	La grippe.
128	Neland.....	"	Jan. 22, '97... 12th	Slight...	.....	Typhoid fever.
129	Neser.....	F.	Jan. 26, '97... 16th	Strong...	.....	Appendicitis.
130	Offner.....	F.	Oct. 2, '97...	None....	.....	Constipation.
131	Oppenheimer..	F.	Sept. 6, '97...	None....	.....	Typhoid fever.
	"	"	Aug. 22, '97...	None....	.....	
	"	"	Aug. 25, '97...	None....	.....	
	"	"	Aug. 29, '97...	None....	.....	
	"	"	Sept. 21, '97...	Fair...	.....	
132	Stone.....	M.	Jan. 7, '98...	None....	.....	Perinephritic abscess.
133	Parantka.....	M.	Dec. 24, '96...	None....	.....	Chronic nephritis; chronic endocarditis; broncho-pneumonia.
134	Peterson.....	F.	July 30, '97...	None....	.....	Solitary tubercle of spinal cord.
135	Poole.....	M.	Sept. 27, '97...	None....	.....	Pyelitis.
136	Quinlan.....	F.	Sept. 30, '97...	None....	.....	Continued fever; anaemia.
137	Quinn.....	M.	March 26, '97...	None....	.....	Pleurisy.
138	Reilly.....	"	Oct. 18, '97... 12th	Fair....	44	Typhoid fever.
	"	"	Oct. 26, '97... 20th	Good....	77	Typhoid fever; relapse.
139	Riesenberg...	F.	Aug. 1, '97... 9th	Good....	47	Typhoid fever.
140	Roberts.....	M.	Nov. 12, '97... 12th	None....	.....	
	"	"	Nov. 15, '97... 15th	Slight...	.....	
	"	"	Nov. 18, '97... 18th	Good....	35	Typhoid fever.
141	Romano.....	F.	Dec. 19, '96...	Good....	50	Typhoid fever (?)
142	Rothschild..	F.	Aug. 24, '97...	None....	.....	
	"	"	Aug. 26, '97...	None....	.....	
	"	"	Sept. 6, '97...	None....	.....	
143	Rower.....	M.	Aug. 24, '97...	None....	.....	Fracture of patella.
144	Schafer.....	F.	Dec. 15, '96... 10th	Fair....	43	Typhoid fever.
	"	"	Dec. 24, '96... 19th	Good....	.....	
145	Scherer.....	F.	April 24, '97...	None....	.....	Pyosalpingitis.
146	Schum.....	M.	Dec. 2, '97...	None....	.....	Abscess of liver.
	"	"	Dec. 4, '97...	None....	.....	
	"	"	Dec. 9, '97...	None....	.....	
	"	"	Dec. 11, '97...	None....	.....	
	"	"	Dec. 15, '97...	None....	.....	
	"	"	Dec. 17, '97...	None....	.....	
147	Seifert.....	M.	Feb. 11, '97...	None....	.....	Bronchitis; otitis media.
148	Siebert.....	M.	Aug. 30, '97...	None....	74	Typhoid fever.
	"	"	Sept. 1, '97...	None....	.....	
	"	"	Sept. 6, '97...	None....	.....	Relapse.
	"	"	Sept. 17, '97... 25th	Good....	.....	
149	Siebrich.....	F.	March 22, '97... 11th	Good....	70	Typhoid fever; relapse.
150	Shannon.....	"	July 12, '97...	None....	.....	Malignant endocarditis.
	"	"	July 17, '97...	None....	.....	
	"	"	July 20, '97...	None....	.....	
	"	"	July 28, '97...	None....	.....	
	"	"	Aug. 7, '97...	None....	.....	
151	Smith, W.....	M.	Oct. 27, '96... 3d week (?)	Fair....	35	Typhoid fever.
152	Smith, M.....	"	Nov. 2, '96...	Good....	.....	Typhoid fever.
153	Smith, A.....	F.	March 31, '97...	None....	.....	Meningitis, tubercular.
	"	"	.....	None....	.....	Constipation.

Considered to be a case of irregular typhoid fever. Headache and general malaise; temperature rather irregular, generally about 101° F., reaching 102° F. three times; no eruption; spleen not palpable. Returned to the hospital about six weeks later with symptoms of gastro-intestinal indigestion, and remained nine days.

Patient had a moderate but very irregular temperature, reaching 102° F. on two or three occasions; no eruption; spleen not palpable; gave a moderate reaction to tuberculin; no evidence of tuberculosis on physical examination.

Course of fever like that of typhoid; spleen palpable; no spots; temperature, 103-4° F.; a daily fluctuation of about one degree. Signs of abscess of the liver became more and more evident. Patient refused operation, and died. No autopsy; pus was obtained from liver abscess with an exploring needle.

Fifth day of relapse.

No.	Name.	Sex.	Date of Examination.	Day of Disease.	Reaction.	Days in Hosp.	Clinical Diagnosis.	Remarks.
154	Smith, P.	M.	April 5, '97...	21st.	Slight...	47	Typhoid fever.	Spleen palpable; eruption present; course of disease regular.
155	"	M.	April 6, '97...	22d.	Fair...	.....	Otitis media.	
156	Spraul.	M.	April 26, '97...	26th	Fair...	.....	Gonorrheal rheumatism.	
157	Stadie.	M.	July 21, '97...	.....	None...	.....	Ia grippe.	
158	Stedney.	F.	Feb. 24, '97...	.....	None...	.....	Acute nephritis; uræmia.	
159	Stebbins.	F.	June 16, '97...	.....	None...	48	Typhoid fever.	
160	"	F.	Aug. 21, '97...	8th	Fair...	.....	Typhoid fever.	
161	Steinbar.	F.	Aug. 23, '97...	12th	Good...	39	Typhoid fever.	
162	"	F.	Sept. 7, '97...	7th	None...	.....	Enteritis.	
163	"	F.	Sept. 13, '97...	13th	None...	.....	Chronic endocarditis; broncho-pneumonia.	
164	Talboys.	M.	Sept. 17, '97...	17th	None...	53	Typhoid fever; femoral phlebitis.	Relapse.
165	Taubert.	M.	Sept. 22, '97...	22d.	Slight...	30	Typhoid fever.	
166	Thurston.	M.	Sept. 22, '97...	22d.	Slight...	51	Typhoid fever; bronchitis.	
167	Tighe.	M.	Oct. 14, '97...	44th	None...	30	Typhoid fever.	
168	Treu.	F.	Oct. 26, '97...	10th.	Good...	49	Typhoid fever.	
169	Tulgo.	M.	Oct. 28, '97...	.....	Good...	.....	Malaria.	
170	Turck.	M.	March 27, '97...	.....	None...	.....	Peripheral neuritis; gastritis.	
171	Unger.	M.	Aug. 13, '97...	.....	None...	.....	Meningitis.	
172	Vosburg.	F.	March 30, '97...	9th	None...	51	Typhoid fever.	
173	Wade.	F.	Nov. 12, '96...	13th	Good...	64	Typhoid fever.	
174	Walsh.	M.	Nov. 16, '96...		Good...		Tuberculosis.	Relapse.
175	Wegner.	M.	May 15, '97...	25th	Good...	.....	Meningitis.	
176	Weeksfelder.	M.	Dec. 4, '97...	.....	None...	.....	Osteo-myelitis; septicæmia.	
177	Wenboin.	F.	Dec. 30, '96...	.....	None...	.....	Meningitis.	
178	Whittle.	F.	June 14, '97...	.....	None...	.....	Septicæmia.	
179	Whitlsey.	M.	July 13, '97...	.....	None...	.....	Ia grippe.	
180	Wichert.	M.	Sept. 27, '97...	.....	None...	.....	Acute lobar pneumonia.	
181	Williamson.	M.	July 8, '97...	.....	None...	48	Appendicitis.	
182	Willie Verget.	M.	Dec. 17, '96...	14th.	Good...	.....	Typhoid fever; broncho-pneumonia.	
183	Wink.	M.	Dec. 21, '96...	.....	None...	.....	Tonsillitis.	
184	Wisman.	M.	Nov. 5, '96...	17th	Good...	40	Typhoid fever.	Relapse.
185	Wolfe.	F.	Nov. 9, '96...	21st.	Good...	.....	Constipation.	
186	Wright.	M.	Sept. 9, '97...	.....	None...	.....	Typhoid fever.	
187	Lasson.	F.	Aug. 11, '97...	6th	Good...	41	Typhoid fever.	
188	"	F.	Aug. 28, '97...	8th	Fair...	45	Typhoid fever.	

188	Rothenhausler.	M.	Aug. 4, '97...	19th	Good....	9	Typhoid fever...	Intestinal hemorrhage; died.
189	Miller.	M.	Nov. 9, '96...	12th	Good....	60	Typhoid fever.	
190	Carlson	F.	Jan. 26, '97...	8th	Good....	54	Typhoid fever; phlebitis.	
191	Kirchenkoff	M.	Dec. 15, '97...		None....		Tuberculosis of lungs.	
192	Berger	M.	Dec. 14, '97...		None....		Typhoid fever.	Still in hospital.
193	Pfeiffer	M.	Dec. 18, '97...	9th	Good....			
194	Hand	M.	Dec. 13, '97...	10th	None....		Rheumatism.	
195	Woop	M.	Dec. 13, '97...	10th	Good....		Typhoid fever.	Still in hospital.
196	Johnson.	M.	Dec. 16, '97...		None....		Alcoholism; rheumatism.	
197	Keivins.	F.	Dec. 9, '97...	13th	Good....		Typhoid fever	Still in hospital.
198	Tully	F.	Dec. 8, '97...	10th	Good....		Typhoid fever; general tuberculosis.	Died.
199	Harris	M.	Dec. 20, '97...		None....		Pleurisy with effusion.	
200	Best.	M.	Nov. 30, '96...	7th week.	Strong....		Typhoid fever; malaria.	Plasmodia malarie were found; quinine had no effect on temperature.
201	D.	F.	Nov. 13, '96...		Good....			Illness one year ago.
202	Unknown	M.	Nov. 13, '96...	25th	Strong....		Typhoid fever	
203	"	M.	Nov. 18, '96...	In relapse.	Strong....		Typhoid fever.	
204	"	M.	Nov. 10, '96...	7th	Fair....		Typhoid fever.	
205	"	M.	Nov. 4, '96...	5th	Good....		Typhoid fever.	
206	W. G. R.	M.	Nov. 5, '96...	6th	Good....			
	"	M.	Nov. 28, '96...	4th	Strong....		Typhoid fever.	
	"	M.	Nov. 30, '96...	6th	Strong....			
207	Unknown	F.	Dec. 4, '96...	10th	Strong....		Typhoid fever.	
208	"	M.	March, '97...	3d week...	Strong....		Chronic nephritis.	
	"	M.	Nov. 10, '96...		None....			
	"	M.	Nov. 14, '96...		None....			
209	"	M.	Nov. 19, '96...		None....		La grippe (?)	
210	"	F.	Feb., '97...		None....		Simple anæmia.	
211	"	M.	Nov. 7, '96...		None....		Ischio-rectal abscess.	
	"	M.	Aug., '97...					

Of cases in which an opportunity was given to determine the time in the disease when the reaction first appears, there are thirty-one. Of these, sixteen reacted in the first week, the average of the days being 5.4. Seven did not react until the second week, the average being 10.57 days. Three gave no reaction until the third week, and five not until the fourth week. Of the five cases in which the reaction was not obtained until the fourth week, two were not tested during the third week, one was in relapse, after several days of normal temperature, and one was an irregular case (131 in table). Of the thirty-one cases, about one-half did not react until after the beginning of the second week, and about one-fourth not until after the beginning of the third week. The average for three-fourths of these thirty-one cases, however, was the seventh day.

Seventy cases were first examined after the end of the first week. Of these, thirty-four were tested during the second week, the average of the days being 10.4. Seventeen were examined in the third week, and six in the fourth week. Of the remaining thirteen cases, some were tested very late in a protracted course of fever, some during a relapse, and some in early convalescence. In fifty-seven cases tested before the third week, the average day of reaction was the ninth.

Of cases clinically diagnosticated typhoid fever, which did not give the Widal reaction, five are recorded. Two of these (Cases 35 and 89) were pretty surely typhoid fever, one (Case 3) was possibly typhoid fever, while two (Cases 33 and 142) were doubtful and were probably not typhoid fever. This would give two cases of undoubted typhoid fever, in one hundred and six tests, in which the reaction was not at any time present.

Four times has the reaction been obtained in diseases other than typhoid fever. One of these, however, may have been typhoid fever (Case 53); one was appendicitis (Case 9), resulting fatally and confirmed at autopsy; one was nephritis (Case 54), and one, at first thought to be typhoid fever, proved to be malaria (Case 90).

Few opportunities have been had for determining the length of time the Widal reaction may persist after recovery from typhoid fever. Five cases examined at periods up to one year after the disease all gave a good reaction, and one case examined after twenty-one months gave no reaction.

It can fairly be said that the results thus far obtained show that

the presence or absence of the Widal reaction in any given case, after repeated tests, is a strong argument for or against the diagnosis of typhoid fever, when there is no history of a previous attack of the disease within three or four years. Unfortunately, in the light of present experience, there are a few cases in which the decision of the test is not final, and these failures, although few in number, together with the delayed appearance of the reaction in some instances, have diminished confidence in its results in cases where a reliable test is greatly needed. On the other hand, to show that the verdict of the test is not in any case to be disregarded or lightly considered, the following history is a notable instance:

A young man came to the hospital during the past summer for an attack of hæmaturia of unknown cause. He gave a history of two similar attacks in the past. When first seen in the dispensary his temperature was 103.5° F., and his spleen was easily felt below the border of the ribs. He had no pain, and at that time there was nothing to call attention to his urinary organs except the hæmaturia. From his symptoms and general appearance he was thought to be suffering from malaria or, possibly, typhoid fever. His blood, examined at this time, showed no malarial organisms, but gave a good reaction to Widal's test. When examined in the hospital, two days later, the spleen could not be felt, but the right kidney was found to be enlarged and slightly tender. The temperature was about the same as before. The blood examined on admission, and several times during the course of the disease, gave, always, a prompt and characteristic reaction to Widal's test. The kidney continued to increase in size, and became more and more tender, and pain became constant and severe in its region. The urine constantly contained a moderate amount of blood and a gradually increasing quantity of pus. The temperature fluctuated widely, between 100° or 101° F. in the morning, and $104-5^{\circ}$ F. in the evening. There was no eruption on the skin and no diarrhœa. The symptoms were all referable to a pyelonephritis. The patient's condition was serious. Before advising operation, the urine was examined bacteriologically, and an abundance of typhoid bacilli was found. The identity of these bacilli was proved by all of the usual tests, and they gave a characteristic reaction with blood from a tested case of typhoid fever. The subsequent course of the disease was that of gradual improvement. The pain and tenderness disappeared, and

the kidney gradually diminished in size. There was never a large amount of pus in the urine, and there was no sudden increase in the amount. All of the symptoms subsided gradually, and the patient recovered without interruption. Without the Widal test, which led to the discovery of the typhoid bacilli in the urine, it is probable that the diagnosis of typhoid fever would not have been made in this case.

XI.

A REPORT OF THREE UNUSUAL CASES OF APPENDICITIS.

BY ELLSWORTH ELIOT, JR., M.D.

CASE I. A. S., aged forty-eight ; married ; housewife ; admitted, January 27, 1897 ; discharged improved, March 11, 1897.

Personal History.—Patient had always enjoyed excellent health until six months ago, when she suffered from an attack of “inflammation of the bowels.” Since then she has been habitually constipated, with occasional attacks of diarrhœa at infrequent intervals. She has never noticed any blood in the stools. Menstruation up to last July generally irregular. Since then she has not menstruated.

Two months ago patient’s present illness began with an attack of pain, dull-aching in character, situated with point of maximum intensity in the right lower abdomen, extending at times from this point downward into the right leg, or to the opposite side of the abdomen, or around the body into the back. This pain has persisted, with occasional periods of relief, up to the present time.

Simultaneously with the development of the pain, patient noticed a small, hard lump, slightly painful on pressure, in the right iliac fossa. This has not increased perceptibly in size during the past two months.

Movement of the right hip has been at times painful, with some stiffness. The right leg has never been swollen.

On admission, temperature, 98° F. ; pulse, 96 ; respiration, 26.

Physical Examination.—In the right iliac fossa a mass the size of a small orange is felt. It is very hard, almost bony in consistency. Its surface is slightly nodular. It is situated just within and below the anterior superior spine, close to the ilium. The abdominal wall over it is movable. The mass, which is slightly tender on manipulation, is apparently attached to the ilium, being only very

slightly movable on it. Vaginal examination negative. There is no evidence of recent or old inflammation in the vertebral column or in the hip-joint. Heart and lungs normal. Patient poorly nourished and anæmic. Tongue coated. No enlargement of the inguinal or other lymphatic glands.

Operation.—Ether. A curvilinear incision was made five inches in length with convex side outward, its centre directly opposite to, and one and a half inches inside the right anterior superior spine. Its upper extremity was on a level with the umbilicus, while, below, it terminated just above and opposite to the middle of Poupart's ligament.

The incision was then carried through the muscles and fasciæ of the abdominal wall to the peritoneum, which structure was separated from the iliac fossa only with considerable difficulty, owing to the presence of firm, dense adhesions that extended between the iliac fossa externally and the intraperitoneal mass internally; this was, however, satisfactorily accomplished without opening the general peritoneal cavity.

A portion of the dense tissue that remained attached to the iliac fascia was then removed and examined microscopically. It was found to consist of dense connective tissue and showed no evidence of malignancy.

The parietal peritoneum was then opened immediately over the mass, the patient having previously been placed in the Trendelenberg position, and the omentum presenting in the wound was found distinctly thickened and adherent to the cæcum. After its separation from that organ, a portion was examined microscopically and found to contain besides the normal quantity of fat a large amount of connective tissue.

Attached to, and apparently incorporated with, the wall of the cæcum on its outer and posterior portion, was a mass, circular in shape and the size of a small orange. Although its central portion was situated at least one inch above the lower extremity of the cæcum, yet its lower portion extended downward sufficiently to surround and to absolutely conceal from view the vermiform appendix. In consistency it was very firm, being hardest in its centre. Its surface was slightly nodular. Sections of the mass examined microscopically, both at the time of operation and afterward in the laboratory of the hospital by Dr. Tuttle, the assistant pathologist, were found

to consist of thickened connective tissue only, showing no evidence or sign of malignancy.

An incision was then made transversely through the mass at a point opposite the termination of the anterior longitudinal band, and at the depth of half an inch the base of the vermiform appendix was exposed. Its further enucleation was accomplished without difficulty, for although embedded in the mass itself, its wall was separate from, and not infiltrated by, it.

The appendix, considerably thickened and only two inches in length, was then ligated with catgut at its junction with the cæcum, and removed, the stump being touched with the actual cautery. Microscopical examination showed considerable chronic inflammation of all its coats.

Digital examination failed to detect any enlargement of the adjacent glands.

The opening in the peritoneum was now closed with catgut sutures. The edges of the wound in the abdominal wall were brought together with interrupted sutures of silk-worm-gut, the central portion only being left opened, through which a drain was introduced into the iliac fossa. Ordinary dressing.

The patient recovered well from the operation. The extremities of the wound healed per primam. From its central portion there was considerable discharge, which gradually subsided, and at the end of three weeks had practically ceased, although a sinus persisted for several months afterward.

The general condition of the patient, however, improved very slowly, and the appetite continued very poor, notwithstanding generous tonic and stimulant treatment. The patient complained continually of the same weakness which she had experienced previous to the operation.

The bowels moved with difficulty, but at no time was there diarrhœa or blood in the stools, which were always well-formed and hard.

Gradually the patient's condition improved, until now, eleven months after the operation, she has entirely regained her former strength and health. The mass in the abdomen has steadily diminished in size, and six months after the operation could scarcely be felt. At the present time it is impossible to detect anything abnormal in the right iliac fossa, save the scar of the wound, which is deeply retracted beneath the adjacent skin.

This case, in its clinical features, closely resembles a new growth. The gradual development of a hard mass in the right iliac fossa, slowly increasing in size, in a patient forty-eight years of age, accompanied by progressive loss of flesh and strength, together with the discovery by exploratory operation of the fact that the mass apparently incorporated the wall of the cæcum and extended into the surrounding structure, indicated a malignant neoplasm rather than a chronic inflammatory process. The microscope failed to reveal, however, any malignant element, and the restoration of the patient's health and strength, with the natural complete disappearance of the tumor, must exclude cancer.

In all the different forms of chronic appendicitis, the inflammatory process is generally limited to the vermiform appendix and to its peritoneal coat (adhesions), and if the adjacent structures are involved, the pathological changes in the appendix are most marked.

In the present case, as a result of microscopical examination, the diagnosis of a slowly progressing chronic productive inflammation must be made, but the starting-point of the process is difficult to establish. Inasmuch as the most marked changes involved the wall of the cæcum, and the pericæcal tissue at a distance from the vermiform appendix, a very reasonable inference would place the original focus in the connective tissue, outside of that organ—in other words, a chronic perityphlitis. Such a process can undoubtedly take place in this situation, although it is of rare occurrence.

Dr. Briddon, attending surgeon to the hospital, kindly gives me permission to mention a case that came under his observation a number of years ago, in which he removed a pin from this situation, that had apparently penetrated the wall of the cæcum, and was causing sharp local pain in the appendical region. I, myself, in the dissecting-room, discovered in the lumen of an appendix presenting the changes of chronic inflammation, a fish-hook. Such foreign bodies readily incite a chronic productive inflammation wherever they may happen to lodge.

In the case under discussion, no foreign body was discovered, and it is perfectly possible that the process had originated in the appendix, and, extending upward, had become more pronounced in the cæcum. Before the microscopical examination, the gross appearances of the mass resembled closely those of scirrhus carcinoma. As has been mentioned, however, no malignant elements

were to be found, and the condition of the appendix itself gainsaid the possibility of cancer; for how could an organ, entirely invested with carcinomatous tissue, escape infiltration? Cancer respects no tissue, although a connective-tissue barrier, as in the walls of large vessels, may temporarily check its advance. No such barrier, however, exists in the delicate wall of the vermiform appendix, the serous covering of which would very quickly become involved in any adjacent carcinomatous process.

The tardy convalescence of the patient must be explained by the persistence of the pre-operative condition. The patient had previously reached the menopause, and, as is well known, the epoch is fraught with many dangers, and accompanied, at times, by a great many constitutional disturbances, without the existence of any pathological lesion to explain their occurrence.

CASE II. T. W., aged twenty-eight; blacksmith; admitted, December 11, 1897.

Previous History.—Negative until six weeks ago, when patient was seized with sharp, severe radiating pain in the right iliac region, which disappeared after three days' rest in bed.

On resuming work, patient experienced no further trouble until two weeks ago, when, again without warning, the pain recurred in the same place, having the same character, and was accompanied by slight pulse and temperature elevation.

As the pain did not abate, Dr. J. W. Lyman was summoned to attend the patient, and examination by him revealed the presence of marked muscular rigidity on the right side, with a local point of maximum tenderness over the situation of the appendix.

These gradually yielded to local applications of poultices and saline catharsis, and at the end of a week the pain had disappeared and only slight muscular rigidity persisted.

Owing to the laborious occupation of the patient, as well as to the repetition of the attacks, an operation was advised and accepted.

Intermuscular Operation.—Ether. The peritoneum was opened, after the usual preliminary steps of the operation, and the cæcum drawn into the wound.

At the termination of the anterior longitudinal band of the colon there projected from the ileocæcal junction a small fibrous cord, one and one-half inches in length, which apparently was a rudimentary appendix. It was ligated with catgut and removed. No

lumen could be discovered in the stump or in the structure removed, which was examined afterward, microscopically, by Dr. Thacher, and found to consist of adipose tissue with a little fibrous connective tissue.

Inasmuch as the actual identity of the part removed was a matter of conjecture, it was deemed advisable to search further for the appendix in the retroperitoneal pouches that exist behind the cæcum, it being a well-known fact that the appendix, in virtue of its peristaltic activity, may turn suddenly upward from the point of its cæcal attachment, and, entering some one of these pouches, disappear entirely from view.

For this purpose an incision was made through the posterior parietal peritoneum, just external to the outer border of the cæcum, and then by blunt dissection that organ was reflected from below upward, and from without inward, until its entire posterior surface was exposed. No appendix was found, and after the exposed portion of the cæcum and ilium had been cleaned with a compress wrung out in hot saline solution, the parts were returned into the abdominal cavity and the wall sutured in the usual way.

The patient made an uneventful recovery, and has worked during the past year without further trouble.

This case presents several interesting features. In the first place, after the patient had suffered from two distinct attacks of appendicitis, operation revealed the presence of, at best, a rudimentary organ which, having its origin from the usual place at the ileo-cæcal junction, was composed of tissue that resembled more the structure of an appendix epiploica than that of a vermiform appendix.

The fact that the vermiform appendix is an organ in a transitional state must be emphasized if any endeavor is made to account for the unusual condition above described.

Various authors have examined fifty or one hundred consecutive appendices in the dissecting-room, and have described, as a result of their observations, many deviations from the normal type. Not only in length (the shortest being less than one inch), but also in the thickness and structure of its wall, and in the diameter and length of its lumen, has the appendix been found to vary.

The wall may be thick or thin. In places the lining mucous membrane and the submucous may have dwindled into a strand of

mere connective tissue. Under these circumstances the opposed walls, formed of connective tissue, coalesce and obliterate that portion of the lumen. This condition would naturally prevent the proper drainage of the distal portion of the appendix which had not been deprived of its mucous membrane, and cystic accumulation



Absence of Appendix. From dissecting-room of Columbia College, Case I.

taking place, would inevitably lead, in the near future, to some serious inflammatory process. In a case of this kind, in which I removed the appendix, three years ago, the patient suffered from such severe and constant pain that ordinary walking even was out of the question. The operation afforded immediate, complete, and permanent relief.



Absence of Appendix—posterior view. (Same.)



Absence of Appendix—anterior view.

In all of these different types, however, the muscular coat is present and does not vary in character.

In the case under discussion the absence of muscle-fibre in the part removed demonstrates the absence of the appendix. In this connection it is interesting to note that appendices are found in which the lumen, enclosed in its muscle-wall, extends only part way to the extremity of the organ. Under these circumstances that portion of the appendix not provided with muscle and lumen, presents the histological features of an appendix epiploica, and practically represents the mesentery of the appendix.

If both muscle and lumen are lacking, there has either been complete atrophy or complete absence of the appendix, and in its place a "modified" appendix epiploica is to be found, as in the present instance.

¹ During the past ten years two cases of this particular type have been observed in the dissecting-room of the College of Physicians and Surgeons of this city, and I am greatly indebted to Dr. G. S. Huntington, the Professor of Anatomy in Columbia College, for placing these cases at my disposal.

In each case the appendix was absent, being replaced by a fold of fatty tissue enclosed by peritoneum, and when the cæcum was opened, careful examination of its wall failed to reveal the orifice of a canal leading into the fatty appendage above described.

At that point its mucous membrane was absolutely smooth, and did not even present a dimple.

The photographs on pages 180 and 181 render any further description of these cases unnecessary.

Secondly, the manipulation of the cæcum is worthy of remark in that the exposure of its posterior wall was readily accomplished through an opening so small as that made in the intermuscular operation. By suitable retraction of this orifice, however, it is possible for the surgeon to divide the posterior parietal peritoneum and to reflect the cæcum in the manner above described.

This must be done very carefully, for two reasons: the first on account of the proximity of the external iliac vessels, and, secondly, because of the nearness of the right ureter. This latter structure may lie parallel to an appendix situated behind the cæcum and may re-

¹ These cases belong to a series of modified or unusual appendices which will subsequently be published by Dr. Huntington.

semble it considerably in appearance. It is because of this near relationship that a severe attack of appendicitis may be accompanied by pain, in nature and location similar to renal colic, but differing from it in that it rarely, if ever, radiates into the right groin and testicle.

The cæcum should always be reflected in the way indicated in order to avoid any interference with its blood-supply. An incision through the posterior peritoneum along the upper and inner borders of that organ would inevitably divide the cæcal arteries and veins which enter and leave the cæcum at that point. Such an accident might be followed by gangrene, as the terminal vessels of the superior mesenteric are not always supplied with anastomosis sufficiently generous to provide adequate collateral circulation.

CASE III. H. C. H., aged thirty-nine; male. Admitted, September 5, 1897.

I am indebted to Dr. W. W. Hewlett, of Babylon, N. Y., for the history of the patient's first attack. This occurred seventeen years ago, when operation for appendicitis was rarely resorted to, and consisted in a very severe and serious illness, which, after six weeks, terminated in the rupture of a large abscess into the bowel, and the discharge, shortly after, of a large amount of matter through the rectum.

After recovering from this attack, patient experienced at times slight pain in the right iliac region, which was not accompanied by any constitutional symptoms. With this exception, the patient has always enjoyed the best of health.

One week ago the pain returned, situated on the right side, and was so severe as to confine patient to bed. There was, however, no chill, fever, nausea, or vomiting, nor was there any disturbance of the bowels.

After three days patient again resumed work, the pain subsiding.

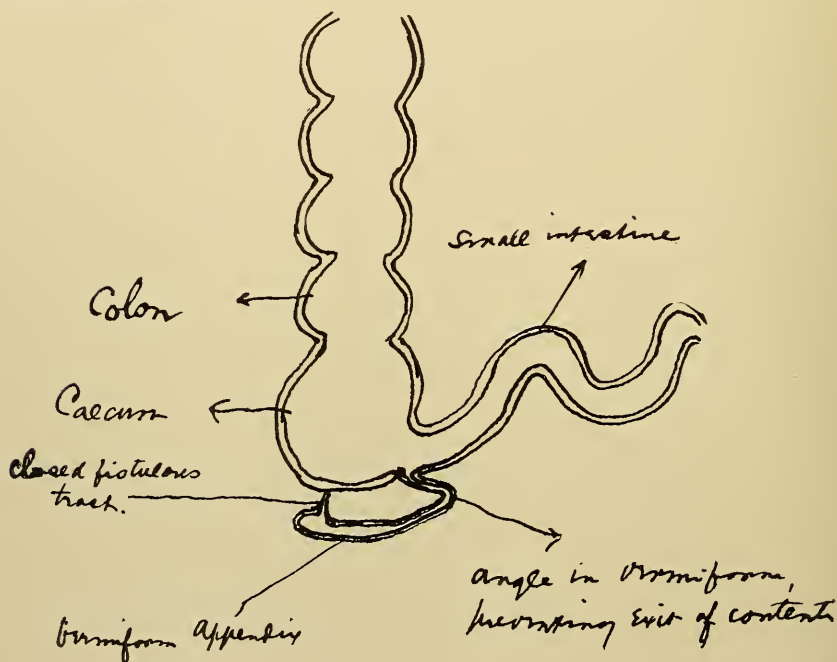
Examination.—In the right iliac fossa, two inches within and slightly below the horizontal level of the anterior superior spine, there was felt a distinct mass the size of a small lemon, movable in all directions, both on the abdominal wall and on the deeper parts. Its surface was firm and irregular. It was tender on pressure. Otherwise the abdomen was negative.

Operation.—Ether. Ordinary incision and the peritoneum opened by the intermuscular operation.

The mass above described was found to consist of thickened

omentum, surrounding what afterward proved to be appendix, and was adherent to the inferior and external surface of the cæcum.

The omentum was so firmly adherent that it could not easily be separated from the underlying structures, and it was therefore ligated with a chain catgut ligature, and divided from the great omentum above. From the interior of the mass, as well as from the surrounding peritoneum, in which it was completely buried, the appendix was enucleated.



It sprang from the end of the anterior longitudinal band in the wall of the cæcum, and for about half an inch passed downward and inward toward the cavity of the pelvis. Turning upon itself, at an acute angle, it then passed directly outward and slightly upward to the lower external portion of the cæcum, being joined at its extremity to that organ by a firm grayish-white cylinder, about one-quarter of an inch in diameter, and three-quarters of an inch in length.

This proved to be the old fistulous tract, through which the abscess had penetrated the bowel at the time of the first attack, seventeen years ago. Its separation from the wall of the cæcum, after

the ligation and amputation of the proximal end of the appendix, was quite easily accomplished, although, in so doing, the cæcal extremity of the fistulous tract was broken open, revealing a lining that resembled mucous membrane.

The communication with the cæcum had entirely closed, but at the conclusion of the operation a probe passed very readily through the fistulous canal into the cavity of the appendix.

The appendix, together with the fistulous tract and the adherent omentum, were now removed *en masse*. To that part of the wall of the cæcum against which the fistulous tract had rested, the Paque-*lin* cautery was applied.

All oozing having ceased, the cæcum was thoroughly dried with hot compresses, and the abdominal wound closed.

The patient made an uneventful recovery.

The case is of great interest because of the pathological condition that was found at the time of operation.

It might reasonably be supposed that the serious attack, seventeen years ago, had entirely destroyed or, at all events, materially "deformed" the appendix, for necrosis is the ordinary fate that awaits tissues involved in a suppurative process. That this does not always take place in suppurative appendicitis has been proved, in a few cases, when an appendix abscess has been opened, and after healing of the parts has occurred, a second attack has taken place, another operation for its relief has been performed, and the appendix found and removed.

In the present case the entire appendix was present, and, with the exception of the sudden bend near its proximal extremity, and the fact that it was completely embedded in thickened peritoneal tissue, the wall and mucous membrane of its cæcal two-thirds presented a normal appearance.

Cases of appendicitis in which there has been rupture of the abscess into the cæcum, with persistence of the fistulous tract, are certainly very rare. In the present case the sharp bend already referred to in the appendix must surely have interfered with the free exit of the mucous discharge from its cavity into the cæcum, had it not been for the presence of the fistulous communication, which, while it remained patent, must have acted as a viaduct for the discharge from that portion of the appendix distal to the above-mentioned

bend. All such communications first contract and then close, and in the present case the closure of the cæcal end of the fistula compelled the contents of the distal five-sixths of the appendix to pass around a sharp angle in its wall before reaching the cavity of the bowel. This, in all probability, could be accomplished only under favorable conditions, and must sooner or later lead to inflammation.

In conclusion, the ease with which the foregoing necessary manipulations could be carried out through a moderately small opening must be mentioned. The wound should be closed, however, only after all hemorrhage has been checked.

XII.

A CASE OF PERSISTENT HICCOUGH YIELDING TO APPLICATIONS OF ICE OVER THE DIAPHRAGM AND TO THE BACK OF THE NECK.

BY ANDREW H. SMITH, M.D.

F. H., aged forty-five; private patient; admitted to Presbyterian Hospital, April 8, 1897.

Family History.—Negative.

Previous History.—Had rheumatism one year ago. Otherwise health has been good.

Present illness began April 5, when, while at dinner, he was seized with hiccough, which has continued up to time of admission, with occasional intermissions during sleep. Patient has no idea as to the cause of the attack. Since beginning to hiccough he has become more and more exhausted. Temperature, 100° F.; pulse, 80; respiration, 16; urine, s. g., 1033, normal.

Physical Examination.—Rather poorly nourished. Somewhat anæmic. Tongue moist and heavily coated. Distressed facies. Patient is hiccoughing almost continuously.

Heart, lungs, liver, and spleen normal. Abdomen soft, not tender. Stomach tympany somewhat increased, succussion marked. Stomach probably somewhat dilated. Throat congested, tonsils somewhat swollen.

April 8. Complains of sore throat, for which spray of a four per cent. solution of cocaine is employed. Tincture of capsicum, ℥ x., given by the mouth, and also nitroglycerine, grain ¹/₁, every hour. Hiccoughed continuously until 8 P.M., when he fell asleep. Slight relief was obtained by inhalations of amyl nitrite.

April 9. Slept all night, except that he awoke twice, when he hiccoughed a few times. Nitroglycerine stopped, and five drops of tincture of capsicum every hour ordered. Complained later of sore

throat and pain in the left ear, the latter greatly aggravated by the hiccough. Silver nitrate applied to the throat, also an antiseptic spray. Hiccoughed continuously from 11 A.M. to 12.30 P.M. *R.* Spirit of chloroform, one drachm every hour. Hiccough a little better. *R.* Trional, grain xv. ; codeia, grain $\frac{1}{2}$, at 8 P.M.

April 10. Hiccoughs when awake, but sleeps a good deal. Applied ice-bag to epigastric region and to back of neck. No hiccough from 2.30 P.M. to 3.30 P.M. though awake. Hiccough from 3.30 P.M. to 7 P.M.

April 11. Hiccough absent since last note. Throat improved.

April 12. Ice-bag removed. Ear and throat better.

April 16. Recovery complete. No hiccough since the 10th.

The point of interest in this case is the prompt improvement under the use of ice applied as nearly as possible to both the origin and the distribution of the phrenic nerves. Though there was a mild tonsillitis present, and the irritation extended to the middle ear, this scarcely seems to have been the source of the hiccough, since it continued with little abatement for some time after the latter disappeared.

The aggravation of the pain in the ear caused by the movement of air through the eustachian tube with each spasm of the diaphragm was a feature in this case which I believe has heretofore not been observed. Had the hiccough continued, it would probably have added to the danger of abscess of the middle ear.

Persistent hiccough is a not very infrequent affection. It is usually associated with some disorder of the stomach, either organic or functional. In the case above cited, though there was no history of gastric derangement, there was evidence of dilatation of the stomach, and the tongue was heavily coated. In a case of gastric cancer under the observation of the writer during the past summer, there were attacks of hiccough several times a day, lasting sometimes for half an hour, or longer, and of such severity as to be heard in the neighboring houses. This condition persisted during the last three months of life. That the origin of the reflex spasm of the diaphragm is most frequently in the stomach is shown by the fact that the milder cases can generally be controlled by simple measures that produce an impression upon that organ. The popular method by sipping cold water, and the general usefulness of capsicum and similar medicaments are illustrations in point. — But there are other

cases which are plainly due to an irritation in the course of either the efferent or afferent nerve, as in mediastinal disease, cervical adenitis, etc. That still other influences may be operative is evident in hysterical cases, and is shown in the causation of paroxysms by irritating the skin of the chin in the case cited below.

Leonhardt describes the case of a man affected with migratory rheumatism, who had an attack of hiccough every time he moved his shoulders in bed, even when the rheumatism was confined to the ankles. Indeed, this symptom, for it is seldom, perhaps never, an essential disease, may attend the most diverse affections in the most varied portions of the body. Irritation of the external auditory canal, concretions in the apex of the lung, erosion of the os tincae, and numerous other conditions have been noted as exciting causes.

It is often of a hysterical nature, and, like other manifestations of this disorder, may become epidemic through the influence of suggestion. Thus, Abeles describes an outbreak in a girls' school that continued for several months, and refers to one in a village in which so many of the inhabitants were affected, that the fact of the epidemic was evident to anyone passing through the streets.

The analogy in some of the more chronic cases to the manifestations of certain forms of chorea suggests the question whether hiccough may not sometimes be in reality a chorea of the diaphragm. As a rule, the hiccough ceases during sleep, but it may be so distressing as to keep the patient awake, or if sleep is forced by the use of opiates, the hiccough may persist notwithstanding.

Though, as a rule, the affection ceases after a variable period, it may continue for months or years. At a meeting of the St. Louis Medical Society in 1882 a case was exhibited that had been active for twelve years, and was still refractory to all treatment.

Cases are not wanting in which the patient has succumbed to the exhaustion consequent upon prolonged loss of rest. Such a case is reported by McCartie, of Newark, N. J., in the *New York Medical Record*, December 1, 1894. The patient was twenty-eight years of age; habits and family history good. No special nervous traits. For years, irritation of a small spot on the chin in shaving would bring on an attack of hiccough, lasting usually only a few seconds, and which could be checked by sipping water, holding breath, etc. The fatal attack was brought on in this way. It lasted about five or

six weeks when death took place from exhaustion. The hiccough was almost continuous, except during sleep. Sedatives gave only the most transient relief. Pressure on the phrenic nerves lessened the severity of the attacks so long as it was kept up. Strapping the lower ribs had some effect outwardly, but the patient declared that the spasms continued internally. Cocaine gave much temporary relief. The irritable spot on the chin was excised, but with no benefit. Massage gave a better result than anything else, producing at one time an intermission of a week. Other fatal cases have been reported, besides a long array in which the patient was rescued only when at the last extremity.

It would be impracticable in this article even to enumerate the drugs and methods of treatment which have been found in turn useful and useless. Of course, the causal indication should first be sought for, and, if found, and the condition proves to be removable, a cure may be expected. But very often this indication escapes us, and we are then forced to treat the hiccough as an essential disease. A very liberal use of narcotics will sometimes not only check the spasms, but effect their permanent arrest. Electricity, either faradic or voltaic, or simple pressure applied to the phrenic nerves, or ice to the epigastrium or the neck, or to both, will occasionally give a good result. Ice to the lobe of the ear has been successful. Pilocarpin pushed to the production of its full physiological effect is highly praised by some reporters. Traction upon the tongue is recommended by Lepine.

Exciting sneezing by the use of a very pungent snuff was sufficient to produce an immediate arrest of the spasms, in a case reported by Slevin.

An excellent résumé of treatment, together with a tolerably full bibliography by Leonhardt, will be found in the *London Lancet* for August 24, 1895.

Other references are as follows:

- SINHA : Musk as a Cure for Hiccough. *Indian Medical Record*, p. 99, 1896.
SHURLEY : Persistent Hiccough, with a Report of Two Cases. *Harper Hospital Bulletin*, Detroit, 1895.
LEPINE : Sur le traitement du hoquet par la traction de la langue. *Comptes Rendus, Soc. de Biologie*, 1896. *Tribun. Méd.*, Paris, 1896.
REGIS : Hoquet et eructations hystériques datant de dix mois ; faradisation ; tétanisante prolongé ; guérison. *Arch. d'électric. méd.*, Bordeaux, 1896.

- ABELES (v.) : Uber singultus-epidimien. Wien. kl. Rundsh., x., 867-85, 1896.
- ROBERTS : Hiccough. Indian Lancet, ix., 56-59, 1897. Also, x., 2-5, 1896.
- DAURIELLAN : Du hoquet dans le cours de la fièvre typhoïde. Bordeaux, 1895.
- JELKS : Bandages in Case of Obstinate Hiccough. Memphis Medical Monthly, xv., 492, 1895.
- BASTINÉ ET DENHÆM : Cas de hoquet rebelle. Arch. méd. Belges Breix, 311-16, 1895.
- HERSCHEL : Case of Hiccough of Unusual Duration and Severity ; Successful Treatment by Galvanism. Lancet, London, December 4, 1897.

XIII.

A STUDY OF A SERIES OF CASES OF ENLARGEMENT OF THE THYROID GLAND EXAMINED WITH SPECIAL REFERENCE TO THEIR HISTOLOGY.

BY WILLIAM N. BERKELEY, M.D.

NOTE.—For the microscope the tissues described in this paper were hardened with formalin and alcohol, embedded in celloidin, and stained with hematoxylin and eosin. In most of the surgical cases the tissue was taken from the operating-room direct to the laboratory. In the specimens gotten *post-mortem*, the autopsy was done always as promptly as possible. It is hoped, therefore, that a minimum of *post-mortem* change was secured.

The numbers in parenthesis are the card-numbers of the specimens in the hospital collection.

MALIGNANT TUMOR.

CASE I (1,953).—C. H., female; aged forty-seven; married; admitted to the hospital, January, 1897, with an enlarged thyroid. She had been always healthy heretofore. Had had a small lump in her neck (middle line in front) for sixteen years; only in the last two years did she notice that it had begun to grow.

Examination showed an enormous growth, occupying the whole front of the neck, not lobulated, larger on the right side than on the left; elastic, non-pulsating. The other organs were negative. The growth was successfully removed on January 21 by Dr. McCosh. Patient, soon afterward discharged, recovered.

Microscopic Examination.—Little thyroid tissue is left (Fig. 1), almost none in normal condition. In the few persistent thyroid alveoli—which are generally distorted and small, with a swelled and hyaline basement membrane—a little blue-stained “colloid” remains. Much of the epithelium is shrunken, pale, and granular. Some still looks normal.

Most of the tissue consists (Fig. 2) of thick rounded or elongated cellular trabeculæ separated by vascular spaces. The latter are

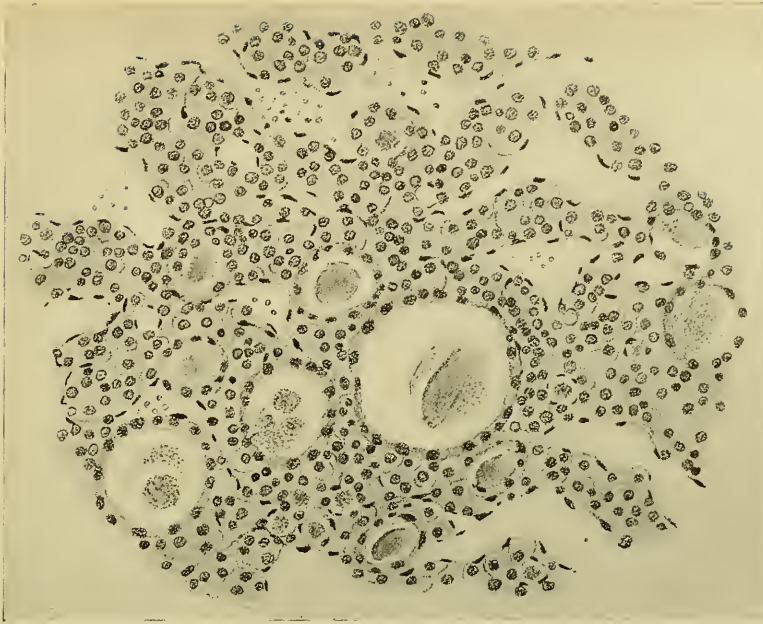


FIG. 1.

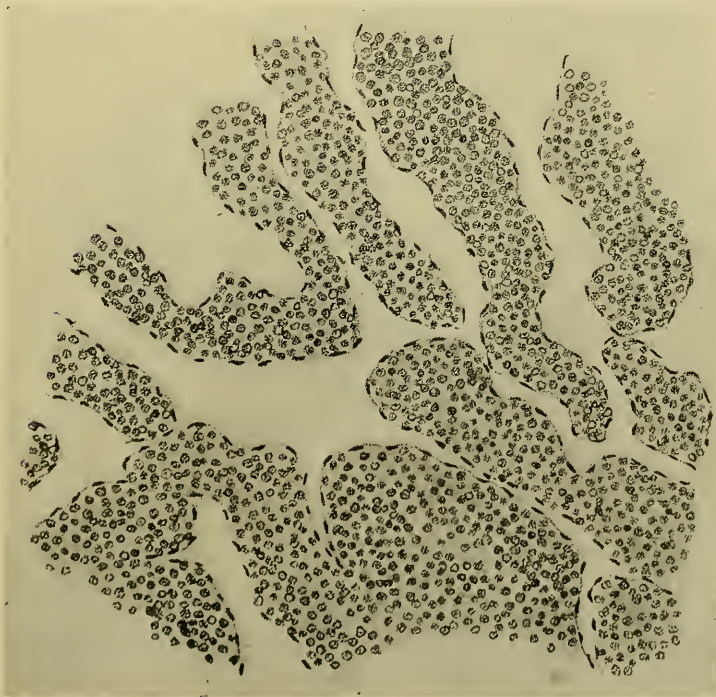


FIG. 2.

of all sizes, sometimes capillary, oftener widely ectatic. They are lined by a regular and symmetrically disposed endothelium, and contain sometimes many, sometimes few, red cells; sometimes a



FIG. 3.

few red and white cells in equal proportions. The vessels are rarely full, often entirely empty. Hemorrhage is present, but rare. The trabeculæ are made up of closely crowded large cells lying in a delicate and extremely scanty connective reticulum. The cells have

round or irregular polygonal outlines, and contain large round or blunt-oval nuclei. On the growing edge of the tumor (Fig. 3) these resemble strongly the nuclei of the thyroid epithelium, but elsewhere are usually larger, paler, less rounded, and with nuclear chromatin less marked. The proximity of the tumor-cells to the thyroid cells, and the seeming continuity of the two is sometimes so close as to suggest strongly that the tumor has an epithelial origin. In general structure, however, the growth is similar to the angiosarcomata described by Thoma, Arnold, Hildebrand, and others.

EXOPHTHALMIC GOITRE.

CASE 2. Young woman; admitted to Bellevue Hospital, March, 1894; service of Dr. W. B. James.

History.—Details not ascertained. She had suffered much, and general health was seriously affected.

Examination.—Showed goitre, exophthalmos, and a very markedly rapid heart—all the typical symptoms of exophthalmic goitre.

Clinical Diagnosis.—Exophthalmic goitre. Part of thyroid excised by Dr. F. H. Markoe, March, 1894. Patient died a few hours afterward; pulse-rate greatly increased before death.

Microscopic Examination.—Epithelium generally increased, sometimes enormously so. Much of it is of the columnar type and very tall. Some is cubical; very little is flat. The nuclei are large and stain brightly. The alveoli are numerous, irregularly tubular or circular on cross-section, of all sizes, the larger ones containing a substance ("colloid") which stains feebly with eosin; many of the alveoli are very small and without lumen or content. Papillary growths are numerous and typical. The connective tissue, about normal in amount and distribution, shows areas of small-celled infiltration. The vessels are not noteworthy increased either in size or number, except in so far as seems necessary to meet the epithelial hyperplasia. A new capillary accompanies each epithelial papilla. The parts of the tissue examined vary much in the degree to which they show these changes. A few alveoli are cystic, and these are lined with an epithelium which is quite flat.

CASE 3. H., aged forty-three; housewife; admitted to St. Luke's Hospital, September, 1894; service of Dr. B. F. Curtis. Enlargement of thyroid and nervous distress for twenty years.

Four years previously symptoms had subsided, but a year before they again became aggravated. Examination showed a non-pulsating, non-fluctuating, bi-lobular thyroid tumor, marked exophthalmos, and nervous phenomena typical of exophthalmic goitre. The apex of the heart was outside the nipple line in the fifth left intercostal space. There was a soft systolic murmur.

Microscopic Examination (Figs. 4 and 5).—Some parts of the gland still quite normal; epithelium cubical or low columnar; alveoli of usual number and size; eosinophil contents with retracted, notched, and toothed margins, homogeneous or granular in appearance, or made up of round, nearly colorless bodies, suggesting degenerate epithelial cell-nuclei. No vacuoles. Other sections show many new alveoli, circular and tubular, lined with a vastly increased number of tall, cylindrical cells. Many alveoli are small, without lumen; some are much larger, but entirely filled by papillary growths. These papillæ vary from a mere bud in size to that

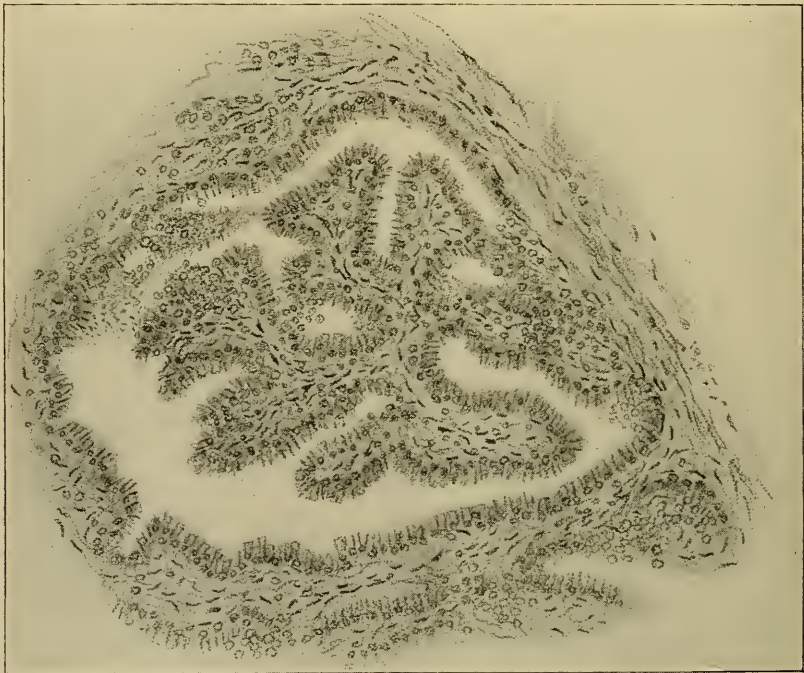


FIG. 4.



FIG. 5.

of a large, well-developed racemose ingrowth (Fig. 5), which quite fills an acinus, distorts the tissue adjacent, and makes the section look like a cross-section of Fallopian tube. A few of the acini have "colloid" contents. Many seem full of normal-staining desquamated cells, an appearance too frequent to be always viewed as a tangential section of a normal pocket. The connective tissue is nearly normal, showing the usual number of spindle-shaped nuclei. It is sometimes infiltrated with leucocytes. Blood-vessels virtually unchanged.

CASE 4 (145 and 2,512). M. B.; aged twenty-eight; married; housewife; admitted to Presbyterian Hospital, January, 1895. Had had present illness for four years. All symptoms confirmed the clinical diagnosis of Graves's disease. On February 5, 1895, right lobe of thyroid was removed by Dr. McCosh. Patient was discharged, March 31, 1895, greatly improved.

Microscopic Examination.—Epithelium much increased; for the most part cylindrical; often tall; much of it is cubical; some polyhedral, very little flattened; the cells are of rather large size, with well-defined nuclei. There is some desquamation of cells, which still take up the double stain in the normal way. Alveoli vary in size, but are generally small; about half of them have no lumen. The content is eosinophil, shows retracted and toothed margins, and sometimes contains bright orange-colored globules and pigment particles. The characteristic papillary formation described in Case 3 is present but rare. There is a slight increase of interstitial tissue, which shows diffused groups of crowded small cells. Vessels are not changed.

It is of interest to add that this same case returned for treatment, May 12, 1897, suffering quite as much as before the first operation. Her condition grew worse after readmittance, and finally became critical. Under a second thyroid operation, undertaken as a last resort, June 17, she succumbed.

When new specimens of the thyroid were prepared, the appearances under the microscope were usually precisely similar to those of two years before. A few minor differences were noted. The alveolar content was usually finely granulated, and stained pale rose, looking rather like celloidin. In some of the small alveoli there was a granular or hyaline blue-staining material. There were often more than one row of cells in a pocket. Some hemorrhage was present.

The pathological diagnosis of "probable Graves's disease" was again made by Dr. Thacher—quite independently of the history, which was not learned till afterward.

Remarks.—These three cases are of value as verifying minutely and precisely the descriptions of the microscopic anatomy in this disease given by Greenfield (*Lancet*, London, 1893, II., p. 1,495), and extensively confirmed (for bibliography, see P. H. Moebius, *Basedow'sche Krankheit*, in Nothnagel's *Spezielle Pathologie und Therapie*, vol. xxii.). Greenfield reports six observations made by himself. The appearances were always those of a "gland in active involution"—like the mammary gland of a nursing mother. Epithelial cells were vastly multiplied, cylindrical, and making papillary ingrowths into the acini. The latter were very numerous and small, often without lumen, often contorted (like a sweat-gland), and con-

taining a thin and pale content. Vessels not changed; connective tissue scanty.

In every one of the present cases the clinical diagnosis was assured and the histology typical. One point only in Greenfield's cases which was absent here is the secondary change—"cloudy swelling and catarrh" of the epithelium. Round cells, always present in the connective tissue in our cases, would indicate that interstitial inflammation is not to be neglected as a possible factor in the process.

CASE 5. This case is of doubtful classification. The histology of the gland is negative, and from the account of the history and physical signs it does not appear that the clinical diagnosis of Graves's disease was more than probable. Dr. B. F. Curtis expects to report this case fully in future. Through his courtesy we give a few details here.

N. C., female; aged seventeen; single; admitted to St. Luke's Hospital, December, 1895; service of Dr. Curtis.

Neurotic history. She went recently, on account of "eye trouble," to an ophthalmologist, who told her she had Graves's disease.

Physical examination showed exophthalmos, puffiness of lids, thyroid enlargement. Heart's action regular; apex not displaced; other organs negative. Clinical diagnosis, Graves's disease.

The growth on section was moderately red, uniform, finely cystic, *i.e.*, granular.

Microscopic Examination.—Nearly normal gland tissue. Alveoli quite generally distended in moderate degree with a homogeneous material, occasionally vacuolated, staining deeply with eosin. In some parts there are a few clusters of alveoli, small and without such content. The lining cells are generally quite low; many are cubical, only a few distinctly columnar. There are no papillary projections into the alveoli. Connective tissue and vessels are not materially altered.

If the clinical diagnosis was the correct one, we may fairly suppose, in the absence of histological agreement, either that the disorder was too recent for the customary cell-change to develop far, or that certain parts of the gland which showed it were not struck by the microtome.

FIBROSIS, HYPERTROPHY, CYST-FORMATION, ETC.

CASE 6 (1,981). M. B., aged sixty-four; married; housewife; admitted to Presbyterian Hospital, January 25, 1897; died a few days later. *Post-mortem* diagnosis, chronic endocarditis, cardiac dilatation, goitre.

History.—Patient native of Württemberg, Germany. Mother, one sister, and many of her neighbors there had thyroid enlargement like her own. Enlarged thyroid from infancy. Thinks it never grew larger except twenty-one years ago, when her only child was born, and perhaps a little in the past year.

Physical examination shows all signs of chronic endocarditis. Goitre more prominent on left side. No exophthalmos. Distinct tremor of hands and entire upper extremities.

Microscopic Examination of Thyroid Gland.—Some alveoli of medium, some of large size, filled with eosinophil matter; lining cells flattened or cubical. Some alveoli small and containing blue-stained material, which is in one mass, or in several closely adjacent globules. Epithelium appears increased in quantity, is sometimes low cylindrical. Vessels congested. Connective tissue little changed.

The enlargement here can be attributed only to increase in the number of alveoli—a glandular hypertrophy.

CASE 7 (542). H. S., adult female; admitted to Presbyterian Hospital, May, 1895, with a large goitre, apparently cystic. She first noticed the enlargement three years ago. General health good. No unpleasant symptoms except slight palpitation of heart on exertion. Right half of tumor excised by Dr. McCosh, May 21, 1895. Discharged cured.

Pathological.—The part removed was $5 \times 2\frac{1}{2} \times 2$ inches, encapsulated. Section granular; very few cysts larger than a pin-head.

Microscopic Examination.—Epithelium usually flat, especially in the larger acini; sometimes cubical, hardly ever cylindrical. Some desquamation. Alveolar content is brightly eosin-tinged, only a little shrunken, often itself containing globes of blue-staining material.

The blood-vessels are not materially altered; connective tissue occasionally increased; usually quite well supplied with normal connective-tissue cells; sometimes infiltrated with round cells. This may, like Case 6, be called hypertrophy, or simple adenoma.

CASE 8 (2,670). C. S., adult male; admitted to Presbyterian Hospital, July, 1897.

History.—Swelling in neck first noticed three years ago, half as large as now. Has grown faster in last six months: Tumor not tender nor painful, only disfiguring.

Physical Examination.—Showed tumor, size of an egg, on left side. Skin over it movable. Tumor itself not movable on deeper tissues. No exophthalmos, no twitching; heart, lungs, and other organs negative.

Tumor removed by Dr. E. Eliot, July 30, 1897, with entirely favorable result.

Microscopic Examination.—Some hypertrophy of gland tissue. Many small cysts. Epithelium normal. Blood-vessels locally much dilated. In places considerable extravasation of blood; contents of the alveoli stain with hematoxylin, and show large ovoid granules (cell-nuclei?) more deeply stained than tissue around, and vacuoles. The latter are often apparently lined by a fine black seam, within which adheres a lightly stained homogeneous, or cellular, or finely granular material. The black line seems to be the circular cross-section of the spherical wall of the vacuole, and the lighter material a zone of "colloid" really external to the sphere. This vacuolation is frequent and typical; and it is found not only in the present specimen, but in several of those described below. There is reason to think that it is not, at least not always, cadaveric. (Gutknecht, *Virchow's Archiv*, 99, p. 314, 1885.)

CASE 9 (2,589). H. W., aged thirty-eight; female; married; housewife; admitted, July, 1897. Tumor first observed nine years ago; no symptoms of distress in speaking, breathing, or swallowing. Not nervous.

Examination.—Well-nourished, no anæmia, no tremor, no protrusion of the eyeballs. Skin of a dark-brown hue. Tumor central, extending from hyoid bone to a point an inch below sternal notch; rounded, symmetrical, elastic, non-fluctuating. Circumference of neck over largest part of tumor, seventeen and one-quarter inches. Heart, normal; pulse, 72, strong, regular; no bruit over tumor; other organs negative.

Successfully operated upon by Dr. E. Eliot, July 2, 1897.

Pathological.—Part removed, $4 \times 3\frac{1}{2} \times 3$ inches. The glandular

structure considerably invaded and replaced by loose fibrous tissue. Alveoli generally small, contents usually staining well with eosin. Epithelium is low cubical; many degeneration-forms. The meshes of the connective tissue are in places filled with a network of fibrin. Scattered in the connective tissue are small round groups of a few gland-cells encircled by basement membrane. There are areas rich in orange-brown particles of pigment. The connective tissue, besides its usual elongated and bent nuclei, contains also nuclei of oval and even round outline (fibroblasts?). The latter are usually grouped in strands or trabeculæ. This case is to be viewed as a fibrous overgrowth or fibroma.

CASE 10 (1,053). A. B., aged twenty-one; single; domestic; German; admitted to St. Luke's Hospital, service of Dr. Curtis, November, 1895. History negative till three months ago, when she noticed in left side of her neck a lump as big as a cherry. This is now as large as a duck's egg, smooth, non-sensitive, elastic. Apex of the heart in the usual position, sounds normal; pulse strong, a trifle rapid. No exophthalmos.

Anatomy.—The excised growth was encapsulated, two inches in diameter, round. Cut surface of a faintly brownish-yellow color, finely cystic, gelatinous, rather like a mass of swollen tapioca grains, but clearer. Alveoli of varying size, some very cystic, this constituting the principal abnormality; generally filled with eosin-stained material, and lined with quite regular low cubical cells; no epithelial papillæ project into the vesicles. There is no small-celled infiltration. The vessels and connective tissue are practically unchanged. This case is pathologically a cystic goitre.

CASE 11 (1,423). D., adult male; admitted to Trinity Hospital, April, 1896. Dyspnœa, slow pulse, no exophthalmos. "Entire gland" was removed by Dr. F. Tilden Brown, April 28, 1896. Dr. Brown has reported this case in its surgical aspects (*Annals of Surgery*, xxv., p. 92, 1897). Patient made a fairly good recovery and has remained well to the present time, December, 1897.

Microscopic Examination.—Alveoli uniformly small, generally few. Cells are cubical or flat, never high. Content is sometimes absent; when present staining bright rose-color. Walls of some alveoli are swelled and colorless, with cells defective. Some acini

are invaded and nearly destroyed by hemorrhage. Interstitial tissue is very abundant, poor in cells, rich in an irregularly distributed eosinophil material. This material shows in places an uneven fibrous network resembling fibrin, and sometimes contains small-celled infiltration. It is rich in red cells.

This growth is properly viewed as a fibrous hyperplasia with atrophy of the parenchyma, and interstitial hemorrhage, both old and fresh.

CASE 12 (1,061). J. L., adult male ; admitted to Presbyterian Hospital, December, 1895, with tumor of thyroid. Patient never had any signs of Graves's disease. Tumor was very large on right side ; the left lobe was about the size of a lemon. Right lobe was excised December 4 by Dr. Briddon. Patient discharged cured, December 24, 1895.

The mass removed was oval, $5 \times 3 \times 2$ inches in size, smooth, of a dark brownish-purple color. On section a mass of small cysts was found, containing for the most part fluid, which was generally bloody, sometimes brownish, or turbid yellow, or clear.

Microscopic Examination.—Glandular structure persistent, but alveoli often remarkably elongated and the septa much thinned. Lining cells greatly flattened. Most alveoli partly full of pale rose-tinted matter, some empty, or apparently so, some holding rather large round cells, some containing blood. Vessels very many, some thrombosed. Alveoli are absent from part of the tumor, and here the connective tissue is abundant, sometimes fatty, sometimes quite fibrous, sometimes infiltrated with small cells, occasionally hemorrhagic.

The growth is fibrocystic, with secondary inflammation.

CASE 13 (988). Adult female ; died in Presbyterian Hospital of puerperal septicæmia, November, 1895. She had had a large goitre from girlhood. It had never troubled her.

Thyroid gland under the microscope shows, in places, increase of connective tissue. In other places the gland-pockets are small, without lumen, crowded, suggesting simple hypertrophy. In the larger acini eosinophil granules and globules (no blue-tinged stuff at all) more abundant than homogeneous matter. Very few large alveoli, none cystic. Epithelium usually cubic, never high. Vessels

not noteworthy, except that once in a while one is found, probably a lymphatic, containing a rose-tinted uniform mass like the "colloid" of the alveoli.

This gland is mostly hypertrophic, a simple adenoma.*

CASE 14 (248). D., aged thirty-five; housewife. No history. Died, with symptoms of pulmonary œdema, a few minutes after admittance to the Presbyterian Hospital, February 26, 1895. *Post-mortem* showed cardiac dilatation, some nephritis, ulcers of stomach, cystic goitre.

Microscopic Examination of the Goitre.—Some sections of the walls of the cysts show characteristic thyroid tissue, others very irregular acini with delicate, flattened cells. Epithelium never columnar. The alveoli contain usually a pale, rose-colored retracted mass, uniform, or granular, or cellular (the cellular matter is part stained, part hyaline), or with quite large pigment-dotted spherules. Instead of the rose-color a pale blue may be sometimes seen. Interstitial tissue increased; vessels rather dilated, full of red cells.

VIRTUALLY NORMAL.

CASE 15 (1,902). E. T.; admitted to Presbyterian Hospital, December, 1896, with hemiplegia which had had a rather sudden onset some three months before. Died January 4, 1897. *Post-mortem* showed cyst of the brain. Thyroid, to the naked eye, was normal; weight, 21.15 grammes. With the microscope (Fig. 6) it showed flattened epithelium and bluish alveolar matter, with vacuoles. Connective tissue quite evenly distributed; lightly fibrous; its cells with fusiform nuclei. Vessels very like normal nutrient vessels elsewhere.

CASE 16 (1,594). A. J., male; aged sixty-four; carpenter. Died of cancer of pylorus, with metastases. Kidneys were chronically inflamed. No thyroid symptoms mentioned in the history. To the naked eye the thyroid was normal.

Microscopic examination shows alveoli of varying sizes filled with a pink matter which contains blue granules, blue globules, and

* This change is common. The literature is full of examples. A recent one reported by Conley (*Trans. Royal Acad. M. Ireland*, VII, 169, Dublin, 1889) is of special interest. The growth was enormous; tissue perfectly normal.

large blue masses almost filling the cavity. Cells low cylindrical or cubical. Vessels (probably lymphatic) frequently contain eosin-stained "colloid." Connective tissue sparingly cellular. No metastasis of the tumor was found.

CASE 17 (1,203). E. D. M., aged seven. General convulsions; sudden onset; died a few minutes after admittance to the hospital. Spinal cord normal. Kidneys were found inflamed. Thyroid to the naked eye normal.

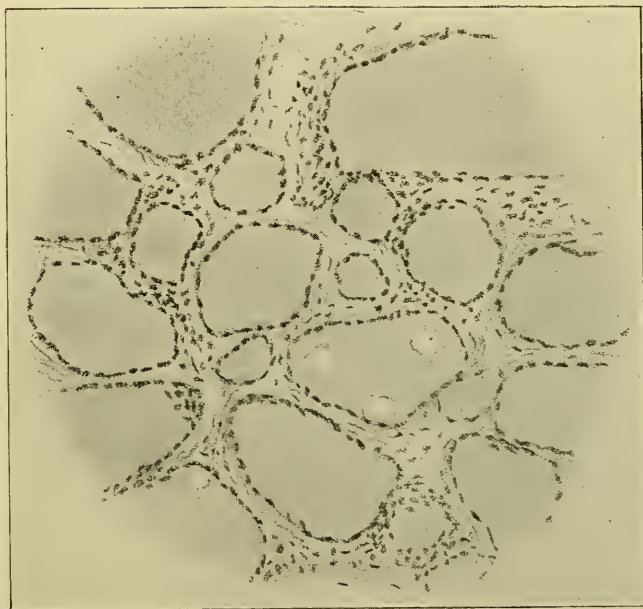


FIG. 6.

Microscopic Examination of Thyroid.—Alveoli small and medium-sized. Cells flat or cubic, very pretty and regular. Content stains sometimes blue, sometimes rose. In places contains refracting granules. Connective tissue well supplied with normal vessels; connective-tissue cells are numerous, with the regular type of spindle-shaped nuclei.

CASE 18 (1,146). T. M., male; aged sixty-three; gardener. Died, January 10, 1896, of cancer of stomach perforating into duo-

denum. Empyema of lungs. Cervical glands enlarged. History makes no mention of thyroid symptoms. The gland was normal to the naked eye.

Microscopic examination of thyroid gland (Fig. 8) shows acini lined with low cubic cells, often in several layers. Alveolar matter

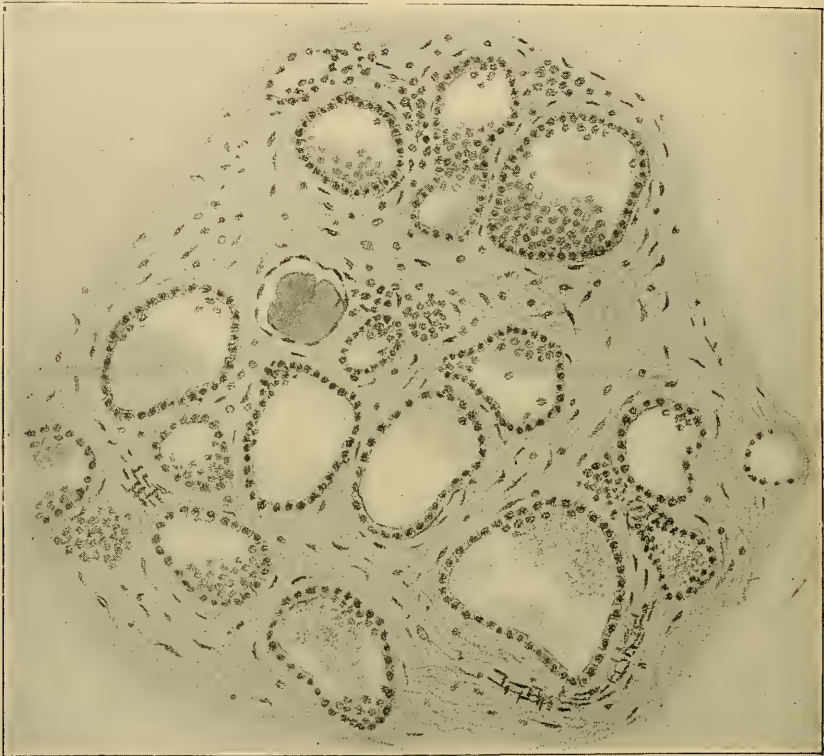


FIG. 8.

sometimes absent (probably fallen out in preparation), sometimes granular and faintly tinged with eosin, sometimes faintly stained with hematoxylin, sometimes made up of nearly colorless cells; at times large globules are found in it brightly colored with eosin. Similar globules lie in the connective tissue, seeming to occupy lymph canals. The connective tissue is quite abundant, vessels normal.

CASE 19 (1,281). A. M., adult female. Died in the hospital, March, 1896, of cancer of œsophagus. *Post-mortem* showed epithelioma (nests of squamous cells) which started from epithelium of gullet and pharynx, and approached the small cartilages of the larynx, but did not pass them. Both lobes of thyroid moderately enlarged. In respect of the thyroid enlargement the clinical history is entirely negative—minute structure of the thyroid generally normal. Epithelium cubical or flat, never tall; alveoli small and large, some cystic. Content uniform, staining little with eosin, with hematoxylin hardly at all, excepting a few scattered globules. Stroma scanty and poor in cells. Vessels unchanged.

CASE 20 (1,264). D., adult female. Died in the hospital, February, 1896, of cancer of the liver, with generalization. Cancer largely cylinder-celled. No *ante-mortem* symptoms referable to the thyroid.

Under microscope (Fig. 7) thyroid alveoli are rather large, content stains blue, with many granules and vacuoles. Cells regularly cubic or flattened, never cylindrical; stroma rather scanty; stromacells with elongated nuclei numerous. Vessels negative.

CASE 21 (1,247). R. S., adult female. Died in the hospital, February, 1896, of cancer of the breast, with extensive metastases. Kidneys were normal; no symptoms of thyroid disorder were noted in the history. In gross appearance the gland was normal. Microscopically, alveoli rather small, very few or none cystic; generally filled with rose-colored matter; cells cubical or flat; connective tissue increased in places. Vessels unchanged.

CASE 22 (1,195). R., adult female. Patient brought in, January 30, 1896, comatose. Died soon after admittance. The supposed cause of death was uræmia, but the microscopic examination of the kidneys showed congestion only. No history was obtained.

Microscopic Examination of Thyroid.—Blue matter occupying nearly all the moderately dilated alveoli. Stroma not observably altered. Vessels quite full of red cells; a few with very thin walls (probably lymphatics) contain "colloid." Epithelium regular, usually cubical, often in multiple rows.

CASE 23 (3,074). C. S.; female; German; aged sixty-seven; housewife. Admitted to Bellevue Hospital, January, 1897, service of Dr. W. B. James. Diagnosis: diabetes mellitus. The history was unreliable. She said she had had "rheumatism" for about three years, also an increased thirst for about the same period. She had never passed an increased amount of urine, and never had œdema

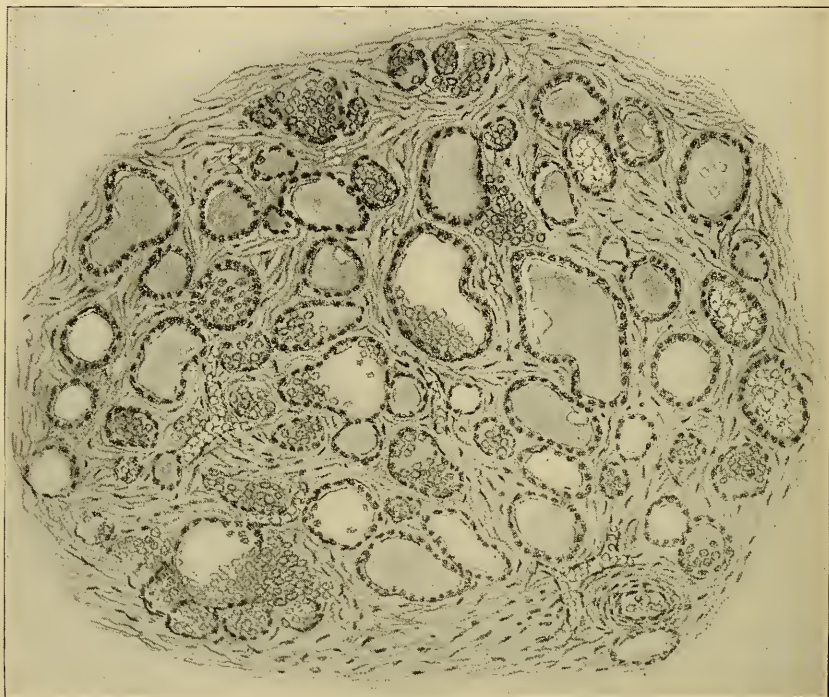


FIG. 7.

At time of admission appetite was good and bowels regular. Examination showed some areas of consolidation in the lungs, with atheromatous arteries. Urine was heavy; saccharine, occasionally albuminous. The patient died unexpectedly about six weeks from date of admission, just after a sudden exertion.

Autopsy confirmed the clinical observations, and showed also marked atheroma of the coronary arteries. Kidneys, liver, and brain were negative. The pancreas showed certain changes which will be the subject of a future report from this laboratory. The

thyroid, to the naked eye, was quite normal. Under the microscope the appearances are those of a typically normal organ. The cells are at times low columnar, generally cubical, in the large alveoli flat. The content is generally pink, and homogeneous; in some of the small alveoli it is granular and blue. The vessels and stroma are in every way normal.

CASE 24 (3,075). Thomas B., aged thirty-two; hospital attendant. Admitted to Bellevue Hospital, March, 1897, service of Dr. W. B. James. Diagnosis: erysipelas (from an old crural ulcer), septicæmia, obesity.

He had always been well, but since his twenty-fifth year had grown enormously obese. His father weighed about two hundred and fifty pounds; his mother was small. Of his four brothers and sisters, two only were obese; the others (one brother and one sister) not at all so. He died five days after admission. At the autopsy the appearances of the viscera were negative. Macroscopically the thyroid showed no change. Microscopically there was no marked change except capillary congestion, which was sometimes enormous. The epithelium was everywhere small and low, sometimes in multiple rows, its boundaries hardly separable from the blue matter of the alveoli. The latter were generally cystic, and the content presented many minor variations in respect of granulations and vacuoles. The stroma was quite normal.

REMARKS UPON THE CASES OF NORMAL THYROID.

It will be observed that the alveolar matter appears as a normal element, and is capable of wide variation in physical character. Besides the usual homogeneous appearance, large and small granules (sometimes refracting strongly) have been noted; globules, pigment particles, epithelial-cells in all stages of degeneration, and probable blood-cells. It can hardly be doubted, also, that the chemical character varies; even in the same section we find matter both rose-colored and blue. For this reason the word "colloid" has been thought an inaccurate descriptive term, and has not been used in this paper except in quotation marks. In the cases of exophthalmic goitre the color is usually pale rose (a fresher secretion?)—hardly ever blue.

Vacuolation has already been remarked upon.

A few high cubical or low cylindrical cells are normal constituents of the gland, and do not in themselves indicate glandular involution; multiple rows of epithelial cells and small hemorrhages in the alveoli may be consistent with normal functions.

These observations agree in the main quite fully with the conclusions of Baber (Baber, E. C., *Philosophical Transactions*, Part III., 1881), whose elaborate monograph is still classic. Baber remarks, too, upon the vertebrate tendency to the columnar form of cell. He has also observed, in normal alveoli, certain small crystals. These were not to be found in the specimens described here.

Case 24 is of special interest in view of the alleged curative effect of thyroid extract in obesity.

XIV.

A REPORT OF FIFTEEN CASES OF ABSCESS OF THE BRAIN.

BY EDWIN S. STEESE, M.D.

THE following compilation is of those cases of cerebral abscess, affording an autopsy, which have been admitted to the Presbyterian Hospital since the year 1875. A list of fifteen cases is presented, and each one is symptomatized as fully and correctly as the records would permit.

It is unfortunate that the physical examination of subjects whose nervous systems are affected must frequently be incomplete, so that the value of deductions from the symptoms of a group of cases is considerably modified. However, as new ideas are possibly suggested, some old ones strengthened, and others weakened, a variable amount of benefit to the advancement of our knowledge is sure to accrue.

The medical treatment, which, in general, was directed toward the alleviation of pain and the reduction of pyrexia, is omitted from the table; while, in those cases operated upon, the findings only of the surgeon are included.

The cases are arranged with reference to the seat of the lesion—the first seven including those with involvement of the frontal lobes, while in the remaining eight the parietal regions were affected. In one case (No. 3) of multiple abscesses, the occipital, parietal, and frontal lobes were the seats of disease; but the involvement of the latter were so much the greatest that the case is included in that group.

Case Number and Initials.	Age.	Admission to Hospital.	Personal History.	Mental Symptoms.	Local Symptoms.	Condition of Reflexes.	Sensation.
1. M. M..	34	April 28, 1891..... Died, May 3.	Five weeks ago received blow over centre of forehead; no symptoms for three weeks; two weeks ago commenced to have headache and feel languid; went to bed; mental apathy increased, and articulation became imperfect; condition of stupor on admission.	Headache; mental apathy, increasing to stupor; difficulty in articulation, becoming aphasia.	Gradually increasing weakness of right arm and leg; rigidity of arm during last two days.	Left tendon reflex exaggerated at first; later, both were lively, and there was ankle clonus.	Increased on left side.
2. C. S...	17	July 1, 1891..... Died, July 7.	Six weeks ago was seized with sudden severe pain in both eyes, dimness of vision and vomiting; pain lasted three weeks and vanished; after one week it appeared in the occipital region; mental dulness accompanied it; pain has grown steadily worse.	Intense headache; delirium and stupor.	Gradually increasing difficulty in swallowing and breathing, especially the latter.	Patellar reflexes absent.	.....
3. C. S. ..	39	August 2, 1891... Died, August 17.	Phthisis for several months; two weeks ago became paralyzed during sleep; was not waked by the shock.	Delirium and stupor; coma during last three days.	Left hemiplegia; occasional clonic spasm of left side, with spasmodic conjugate deviation; convulsions daily; difficulty in swallowing.	Right patellar reflex increased, and ankle clonus; reflex present on left side.	Diminished on left side.
4. A. H. .	(?)	April 15, 1895 Died, May 9.	Six months ago received fracture of base of skull; was trephined in frontal region, and considerable fluid was withdrawn; discharged from hospital, cured; two weeks ago began to have pain at seat of trephine, over right eye; pain was steady and, seemingly, within the eye.	Pain; apathy, becoming stupor.	Left hemiplegia; twitching of fingers of right hand and of face; unable to swallow during last two days.	Patellar reflexes lost.	.....
5. B. J. ...	25	October 21, 1895.. Died, October 28.	One week ago began to suffer from headache and general malaise; the day before admission had several indistinct chills.	Constant headache.	None	Normal	Normal...
6. Unknown woman.	(?)	November 30, 1896 Died, December 2.	Was struck by a cable-car, and received a linear fracture of skull.	.....	Spasms, commencing in left side of face and extending to arm and leg; no paralysis; rigidity of arm and leg later.	.....	.....
7. M. S. .	45	August 14, 1897.. Died, August 18.	Bullet removed from head ten months ago; discharged in five weeks; returned to hospital in four months; a sinus was opened and some powder removed; it healed rapidly; up to date has suffered some from headache.	Headache; stupor and coma.	Twitching of right hand and leg; slight paralysis of left side; difficulty in swallowing.	August 15, patellar reflexes increased and ankle clonus; August 16, reflexes diminished and no clonus.	.....
8. S. S. .	16	July 27, 1875..... Died, August 8.	Has had discharge from right ear for five years; eight days ago was seized with severe headache and vomiting.	Headache; mental apathy for ten days; on the eleventh day sudden deep stupor and coma.	.....	.....	.....

Aural and Ocular Symptoms.	Respiration, Pulse, and Temperature.	Miscellaneous Symptoms.	Duration and Course of Disease.	Autopsy.	Cause of Abscess.	Operation.
Drooping of eyelids; lachrymation; dilatation of pupils.	Pulse slow, bounding, and irregular; temperature averaged 99.8° F.	Breath very offensive.	Duration, three weeks; initial period, two weeks; terminal, one week.	An indentation was found in forehead to the left of the median line and 1½ inches above nasal notch. One inch to the left of this was the trephine opening; extravasation of blood about opening and temporo-parietal suture; frontal convolutions completely disintegrated; over the motor area was a blood-clot.	Traumatism	Patient was trephined and considerable purulent serum withdrawn from within the lateral ventricle apparently; no focal lesion was found.
Pupils dilated ..	Respiration labored, and, at times, stertorous; pulse averaged 50; temperature averaged 100.5° F.	Vomiting; incontinence of urine; obstinate constipation.	Duration of disease, seven weeks; initial period lasted three weeks; latent, one week; and the terminal, three weeks.	A cavity, ½ inch in diameter, was found in the left frontal lobe; directly about cavity a firm zone existed and, beyond, softening, extending almost to ascending frontal convolution; the frontal sinus was perforated; medulla not involved.	Secondary to disease of the frontal sinus.	None.
Pupils dilated; left external strabismus during spasms.	Respiration stertorous at times, Cheyne-Stokes finally; morning temperature below normal, afternoon exacerbations; average, 100.2° F.	Cough, sphincters relaxed.	Duration, four weeks; entire course very severe.	Abscess, 1 inch in diameter, at upper end of fissure of Rolando; another, the same size, in occipital lobe; also a large cavity in left frontal lobe, extending to fissure of Rolando and involving part of third frontal convolution; several spots of pneumonia in left lung; abscess cavity in apex of right lung.	Probably a result of disease in the lungs.	None.
.....	Respiration shallow and irregular; temperature averaged 100.5° F.	Vomiting; sphincters relaxed; profuse perspiration; no rigors.	Duration, eight months; initial period dates from injury to the first operation, about one month; latent period was five months, and the terminal, two months.	A large abscess in right frontal lobe, extending to within 1 inch of fissure of Rolando; the right temporal and left frontal lobes were compressed; a few foci of suppuration at top of left parietal lobe.	Traumatism....	Eight ounces of pus were removed from the right frontal lobe.
.....	Respiration and pulse were good; finally both failed suddenly; temperature averaged 99.5° F.	Indistinct chills; vomiting; constipation; enlarged spleen; abdomen distended.	Duration, two weeks; initial period, one week; terminal period, one week.	Convulsions flattened; abscess, 1 inch in diameter, in left frontal lobe; entire lobe is softened; no disease of the sinuses evident.	 (?).....	None.
.....	Temperature averaged 103° F.	.....	Duration, three days.	Linear fracture of skull; two large abscesses in frontal lobes; laceration of cerebellum; pneumonia; mucopurulent matter in smaller bronchi of both lungs.	The septic process in the lungs, probably; traumatism (?).	None.
Right pupil dilated, the left contracted.)	Temperature rose rapidly during last four days from 99.6-105.4° F.	One rigor	Duration, probably, about seven months, dating from second visit to hospital, in February; terminal stage lasted four days.	Entire right frontal lobe honeycombed with abscess cavities.	Traumatism....	Normal brain was exposed during the operation; no pus was found.
Chronic otitis media.	Pulse very hard	Vomiting; obstinate constipation.	Duration, twelve days.	Dura closely adherent to base and left temporal region of skull; right lateral ventricle filled with pus, and right temporal lobe occupied by an abscess; much softening about cavity.	Chronic otitis media.	None.

Case Number and Initials.	Age.	Admission to Hospital.	Personal History.	Mental Symptoms.	Local Symptoms.	Condition of Reflexes.	Sensation.
9. J. C....	56	August 22, 1891 .. Died, August 26.	Five weeks ago received blow on right side of head; immediate aphasia and left hemiplegia; partial recovery in ten days; four weeks later increasing paralysis and relaxation of sphincters; delirious three days ago; grew steadily worse.	Delirium; stupor; aphasia.	Left hemiplegia; twitching of right upper extremity and face; aphasia; imperfect expansion of left side of chest.	Right patellar reflex sluggish; left exaggerated.	Diminished over entire left side.
10. C. C....	27	July 2, 1893	Blow on occiput followed by slight dizziness and headache; latter increased gradually; when admitted had severe headache, and soon became delirious and unconscious; tenderness about neck; retention of urine.	Delirium; stupor, increasing rapidly to coma.	.....	.....	.....
11. J. O.	(?)	June 4, 1894..... Died, June 7.	Four days ago patient entered dispensary, unable to give any account of himself for the last week; wound was found over occiput; the next day there was puffiness over left mastoid and bloody discharge from ear; patient was dull and stupid; he was treated and sent home, at his request; two days later was brought in by ambulance.	Stupor; coma.	.....	.....	.....
12. J. D....	22	July 1, 1894..... Died, July 9.	Ten days ago began to have intense frontal and occipital pain; it has been constant since; dyspnoea on exertion; cyanosis; congenital heart disease.	Headache, frontal and occipital; stupor, increasing gradually to coma.	Right hemiplegia; deglutition very difficult; deviation of tongue to right.	.....	.....
13. A. M. B.	7 wks.	December 12, 1894 Died, December 22.	The day before admission began to have epileptic attacks, and had ten during the twenty-four hours; physical examination negative; no symptoms except during a convulsion.	.....	Rigidity of left arm and leg, and twitching of left eye during seizures; duration of attacks, one-half minute; two to four daily.	.....	.....
14. P. A.	27	October 2, 1895... Died, October 25.	Received a compound fracture of skull in anterior parietal region of the right side, near the median line.	Severe headache.	Complete paralysis of left leg; partial paralysis of left arm; rhythmic contraction of left shoulder, arm, and forearm; partial paralysis of left side of face; firm tremor of right side the day before death.	Exaggerated..	Normal..
15. G. M....	35	February 7, 1896.. Died, February 7.	Four days ago had a convulsion; this morning had a severe chill, and rapidly became unconscious.	Comatose	Had ten general convulsions during the day; hands and arms involved first, then the lower limbs and head; spasmodic conjugate deviation; no paralysis.	Left patellar reflex much exaggerated.	.....

Aural and Ocular Symptoms.	Respiration, Pulse, and Temperature.	Miscellaneous Symptoms.	Duration and Course of Disease.	Autopsy.	Cause of Abscess.	Operation.
Pupils unequal; left fundus oculi congested.	Temperature averaged 100.5° F.	Relaxation of sphincters.	Duration, six weeks; initial period, immediate after blow; latent period, ten days; terminal period, four and one-half weeks.	Just posterior to junction of fissures of Rolando and Sylvius is a ragged cavity, 2½ inches in diameter, with regular abscess-wall; around cavity is a softened area involving lateral ventricle.	Traumatism....	Trephined; copious escape of creamy pus; cavity extended upward and backward in direction of fissure of Rolando; ascending frontal and parietal convolutions destroyed.
Pupils contracted at first, later dilated.	Temperature averaged 103.5° F.; several baths daily were necessary to restrain it, but the benefit was only temporary.	Retention of urine; constipation; stiffness of neck.	Duration, two weeks; initial period, three days; terminal period, eleven days.	An abscess, 2 inches in diameter, was found in left temporal lobe; general meningitis, especially at base of brain.	Traumatism....	None.
Bloody discharge from left ear; puffiness over left mastoid.	Temperature ranged between 104.5° F. and 107.5° F.	None.....	Duration (?): patient was one week at hospital; the date of injury not given.	Cavity, with ragged walls, in middle of left temporal lobe descending along lateral ventricle; disintegration of tissue and small hemorrhages in right frontal lobe; thrombus in left lateral sinus.	Traumatism....	Depressed fracture at lower posterior angle of left parietal bone; pus everywhere; piece of inner table driven into brain at that point, and a cavity there, 2 inches in diameter, full of pus; lateral sinus not injured.
Rhythmical contraction and dilatation of pupils.	Respirations slow and almost stertorous; temperature averaged 100.5° F. and was restrained by antipyretics daily.	Relaxation of sphincters.	Duration, about three weeks.	Abscess cavity occupies almost all of left temporo-sphenoidal lobe; it has a firm capsule, beyond which there is much softening; much yellow exudation in pia about cerebellum; congenital heart disease, opening between ventricles just below aortic valve.	Congenital heart disease.	None.
.....	Temperature averaged 98° F.; lowest, 97.3° F.; highest, 100.6° F.	Cried out, frequently, in a very distressed manner.	Duration, eleven days; disease progressed steadily.	Right parietal lobe almost entirely occupied by an abscess; communication between abscess and posterior horn of lateral ventricle; apparently no communication between anterior and posterior horns of ventricle; lateral ventricles distended with pus; an abundant yellow exudation at base of brain.	Tuberculosis ...	None.
.....	Temperature averaged 101° F.; during the last two days it rose rapidly.	.....	Duration, three weeks; disease progressed steadily	General meningitis with some pus at the base; a large abscess cavity with softened, ragged walls in the right parietal region; some pus in both lateral ventricles; miliary tubercles in the lungs.	Traumatism; tuberculosis.	Patient was trephined and an abscess, ½ inch in diameter, was found in the right parietal region.
.....	.....	One severe chill.	Duration, three days; course very acute.	Dura adherent over right parietal lobe; beneath dura a number of foci of suppuration with considerable hardened tissue about them; the interior of parietal lobe was unusually white and softened in places.	(?).....	None.

It is regretted that shortness of time compels a brief and hurried résumé of the symptoms presenting in the above cases. These will be considered in regular order as they appear in the table.

Sex.—The ratio of males to females is almost four to one, but this large proportion of males is evidently a result of their greater liability to injury, for, of the non-traumatic cases, there is an equal number of both sexes.

Age, under 1 year.....	1 case.	Age, 30-39 years.....	3 cases.
“ 1-9 years	no cases.	“ 40-49 “	1 case.
“ 10-19 “	2 “	“ 50-59 “	1 “
“ 20-29 “	4 “	(?) “	3 cases.

Thus the largest number of cases occurred in the third decade of life, and one-fifth in the fourth decade. Two-fifths of the total number were between twenty and thirty years of age.

Mental Symptoms.—Headache, of different degrees of severity, occurred in eight, and probably nine of the cases, and was almost invariably accompanied by some form of mental disturbance of the nature of irritability, apathy, stupor, and coma. Presumably, the pain in these cases was general, no reference being made to locality except in one instance, Case 2, in which, during the initial period, it seemed located in the frontal lobe, vanished during the latent period, and appeared suddenly in the occipital region during the last stage. In five cases headache was not present, consequently no great reliance can be placed upon it, alone, as a diagnostic sign.

Aphasia gradually resulted in Case 1 from the slow extension of the disease backward and downward. It was present, also, in Case 9.

In two cases no mental disturbance was recorded, one patient dying soon after admission, and the other being an infant. The latter, however, gave utterance to frequent sharp cries, caused, undoubtedly, by some form of cephalic pain.

Local Symptoms.—Partial paralysis of one or the other side of the body occurred in seven cases, in four of which there were also symptoms of cortical irritation on the side of the lesion, indicated by twitching of the face and hand.

Spasmodic conjugate deviation was present in two cases, Nos. 3 and 15.

In five cases special stress was laid upon the gradually increasing difficulty in deglutition, and, in one of these, Case 2, the respiratory centre was also involved. Unilateral spasm was observed in two instances, and general convulsions in only one.

In four cases there were, seemingly, no focal symptoms.

Reflexes.—Unfortunately, the condition of the reflexes received little attention. Reference to the table will show that ankle clonus is much more in evidence than would generally be expected, which tends to prove an unusual reflex excitability in abscess cases.

In one case, No. 4, of left hemiplegia, both patellar reflexes are recorded as lost; and in another case, No. 7, they are exaggerated, and there is ankle clonus on one day, while on the following day they are diminished, and the clonus has disappeared.

Sensation.—In two cases sensation was diminished on the side of the lesion; and in a third instance, was increased on the opposite side. Of the remaining cases, two had normal sensation and the rest were not recorded.

Aural Symptoms.—Only one case, No. 8, shows a primary disease of the middle ear, of at least five years' duration. The discharge was more or less constant during this long period, and, which is especially noteworthy, was active at the time of onset of the cerebral symptoms.

Ocular Symptoms.—No careful examinations of the fundus oculi were made; at least none are recorded. The pupils were affected in about one-half the cases.

Respiration.—Breathing was labored and stertorous in three cases; shallow and irregular in one other. In case No. 5 there was sudden failure of the respiratory and heart centres.

Temperature.—The temperature averaged about 100° F. in all the uncomplicated cases.

There was, generally, a high pre-mortem rise; otherwise, the fever line was fairly steady. In the complicated cases the temperature averaged high with daily exacerbations and remissions.

Miscellaneous Symptoms.—Vomiting was present in four instances, as was also obstinate constipation. The sphincters were involved, generally relaxed, in six of the cases. In two cases a severe rigor introduced the terminal stage of the disease, and in one other indistinct chills were experienced during the initial period. The condition of the appetite was not recorded directly, but judging

from the daily treatment, it was in marked contrast to the voracious desire for food occasionally noted in books as being a common symptom.

Duration.—In the acute cases the duration varied from three days to four weeks. In seven cases the entire course was very severe; in three, an initial and terminal period were very noticeable. The chronic cases varied in length from six weeks to eight months, and all of them presented three typical stages, the latent ones varying from one week to five months.

Pathology.—Reference to the table will establish the location of the lesions; and a comparison of the findings at the operation and the autopsy will, in several cases, show a considerable difference in the size of the lesion, and give some idea of the rapidity of extension of such morbid processes.

Cause of Abscess.—Under the head of Personal History will be given, in most of the cases, some idea of the exciting cause of the abscess, but occasionally an autopsy was necessary for its determination. In two cases no reason can be assigned, there being no history or direct evidence of traumatism, or any disease. In another case congenital heart disease was the only abnormality found which might account for a cerebral abscess.

The following brief discussion is a comparison, only, of the cause, course, and symptoms of the above cases of cerebral abscess, and of the prevailing ideas relating to the diagnosis of that disease. Headache, of varying intensity, some mental disturbance, abnormal temperature, chills, gastric irritability, some change in note on percussion in the vicinity of the abscess, optic nerve involvement, disturbances in the field of vision, convulsions and focal symptoms are generally accepted as being of great importance, when they exist in some combination, and careful consideration is also given to the etiology and course of the disease. Otherwise, cerebral abscess is, generally, very difficult of diagnosis, the symptoms being so variable in number, character, and degree, that meningitis and sinus thrombosis are especially hard to differentiate; and, occasionally, the extent of an otitis media is unsuspected until sudden severe cerebral symptoms appear and determine the process.

Even a careless consideration of the résumé is sufficient to convince the most enthusiastic that none of the symptoms recorded in

the table have any individual diagnostic value. All of them may occur in other conditions, vary much in their severity, while some are frequently wanting altogether. Occasionally, for instance, headache is absent, or, if present, is mild in character, or terribly severe. Other mental symptoms may appear, varying from a restless delirium to profound stupor. Careful consideration of the patient's usual disposition must be considered, and due weight should be given any recent mental condition contrasting with his customary state of mind.

Temperature cannot be relied upon, although a low rate is pretty constant in uncomplicated cases of cerebral abscess; but these pure cases are very few, and a slight implication of the meninges or sinuses greatly modifies the character of the fever. Chills, when present and accompanying varying degrees of mental disturbance, are of great importance, but their absence is very common. Undoubtedly, percussion is of much assistance, but, unfortunately, it was not tried in any of these cases. Optic neuritis does not appear as a symptom, and no mention is made of any visual disturbance; so, presumably, their aid was not necessary to confirm the diagnosis. General convulsions rarely occur except on rupture of the abscess and involvement of the ventricles, and is of little value except as indicating the beginning of a very grave state of affairs. Local spasms are of some importance in locating the position of the lesion. The same may be said of focal symptoms in general; alone, they do not indicate the character of the lesion—merely its position. The appetite seems to be diminished or entirely wanting, as would be expected during an inflammatory process. Thus it seems that very little reliance can be placed on any of the symptoms, but their combination and order of development, dating from a variable time since the reception of some degree of injury to the head, or of the onset of some disease known to make liable the formation of a cerebral abscess, make the diagnosis clear.

XV.

A REPORT OF FORTY-ONE HYSTERECTOMIES PERFORMED DURING THE PERIOD OF TWO YEARS, NOVEMBER 1, 1895, TO NOVEMBER 1, 1897, ON PATIENTS ADMITTED TO DR. MCCOSH'S SERVICE AT THE PRESBYTERIAN HOSPITAL.

Being a Record of all those Patients upon whom this Operation was Performed that were Admitted to Dr. McCosh's Service during that Interval.

BY FORBES HAWKES, M.D.

IN this paper no attempt has been made to mention in an exhaustive manner all the conditions which may call for the removal of a uterus, nor are the advantages of any one method discussed except as bearing upon the cases here collected. On these pages are recorded all the hysterectomies, forty-one in number, performed on patients admitted to Dr. McCosh's wards in the Presbyterian Hospital during the last two years—November 1, 1895, to November 1, 1897.

Mention has been made for each case of the pathological conditions necessitating the removal of the uterus—of the methods followed in the preparation of the patient—of the details of the operative technique in the vaginal abdominal and vagino-abdominal routes, together with the post-operative treatment and the resulting condition in each case.

In Table I., at the end of the report, are collected all the cases done by the vaginal route, 11 in number with 1 death.

In Table II. are collected all the cases done by the abdominal route, 26 in number with 3 deaths.

In Table III. are collected all the cases done by the vagino-abdominal route, 4 in number with 2 deaths.

The pathologist's report of the microscopical findings in all cases examined is also given at the end of the report.

In considering these cases it should be borne in mind that these records are not by any means those of "selected cases" examined outside and sent to the hospital for operation; they actually represent the results obtained in the wards of a general hospital. Some of these patients sought admission of themselves in a late stage of their disease; others were conveyed to the hospital by their friends; still others were brought in by the ambulance in a critical condition.

The presence simply of adhesions has not been considered to be a contraindication to the vaginal route. If firm and unyielding, however, and so numerous as to obscure the intrapelvic relations to any marked extent, it has been considered safer for the patient that these adhesions should be divided from above, where they can be clearly seen. The extra risk run by the patient in a case of this sort in having her uterus removed through the vaginal canal should be clearly stated to her should she insist (as patients oftentimes do) that the organ be removed in this way without the production of an abdominal scar.

THE "VAGINAL" ROUTE.

This method was chosen in 11 cases for the following lesions:

Carcinoma, 3 cases, 22, 23, 28, Table I.

Sarcoma, 1 case, 1, Table I.

Endometritis, clinically malignant, 2 cases, 29, 36, Table I.

Prolapse and retroflexion, 1 case, 9, Table I.

Polypoid degeneration of endometrium, 1 case, 2, Table I.

Menstrual insanity, 1 case, 32, Table I.

Pyosalpinx, 1 case, 14, Table I.

Pelvic abscess, 1 case, 31, Table I.

In a general way preference was given to the vaginal route in the removal of the uterus in all cases where it was considered possible to do so with safety, and where the contemplated procedures could be carried out through this channel. In cases of uncomplicated carcinoma of the cervix, this operation has gradually supplanted the high amputation of the cervix, as the operative technique has become elaborated and the methods of avoiding danger better recognized and adopted.

THE " ABDOMINAL " ROUTE.

This method was chosen in 26 cases for the following lesions :

Fibroid tumors, 20 cases, 3, 4, 6, 7, 8, 10, 15, 16, 17, 20, 21, 24, 25, 26, 30, 35, 37, 38, 39, 40, Table II.

Large malignant tumors (sarcoma (2), malignant adenoma), 3 cases, 18, 19, 34, Table II.

Prolapse, 1 case, 14, Table II.

Puerperal septic metritis with general septic peritonitis, 1 case, 41, Table II.

Chronic pelvic peritonitis, 1 case, 12, Table II.

In a general way preference was given to the abdominal route alone in the removal of large tumors of the uterus, of whatever nature ; also when access to the general peritoneal cavity was desired for the treatment of a septic uterus with an accompanying general septic peritonitis. In moderate cases of prolapse where it was desired to anchor the upper end of a dilated and hypertrophied vagina in the abdominal wound, this route was chosen.

THE VAGINO-ABDOMINAL ROUTE.

This method was followed in 4 cases for the following lesions :

Fibroid tumors, 2 cases, 5, 33, Table III.

Prolapse, 1 case, 13, Table III.

Pyosalpinx, 1 case, 27, Table III.

In 3 of these cases (the 2 of fibroids and the pyosalpinx case) the operation was begun by the vagina in the hope of being able to remove the uterus safely by this route. After the general peritoneal cavity was opened, however, such conditions were found to exist as to lead the operator to take what seemed a safer course and to complete the further details of the operation through an abdominal incision. In the other case, that of a large prolapsed uterus with enormously hypertrophied vagina, with bladder pulled down in front and rectum behind, and both anterior and posterior pouches filled with intestine—the whole hanging down as an ulcerated mass outside the vulva, half-way down to the patient's knees—the vagino-abdominal route seemed the safer one from the start, especially as it was desired to anchor the upper portion of the severed vaginal canal in the abdominal wound to assist in curing the prolapse.

PREPARATION OF PATIENT PREVIOUS TO OPERATION.

The following routine preparations are made in all cases, whatever route be chosen :

A general cleansing bath is given to the patient on the afternoon of the day previous to operation. The abdomen and the hairy growths on the mons and vulva are shaved and thoroughly scrubbed with brush and green soap ; a green-soap poultice is then applied, consisting of several layers of gauze, soaking wet, with a fifty per cent. watery solution of green soap. This is covered by rubber tissue and left on for about six hours, when it is removed, the soap washed off and the skin cleansed with a warm 1 to 1,000 bichloride solution ; gauze compresses, soaking in a 1 to 3,000 bichloride solution, are then applied and covered with rubber tissue ; these are left on till about two to three hours before operation, when the abdomen and vulva are again scrubbed with green soap, followed by a cleansing in order with ether, alcohol, saturated solutions of permanganate of potash and oxalic acid, and a warm 1 to 1,000 bichloride solution. Compresses soaking in a warm 1 to 3,000 bichloride solution are then applied to the abdomen and vulva, to be left on until the patient is anesthetized and placed upon the operating-table.

The vaginal canal and parts about the vulva receive in all cases the following special preparations :

On the afternoon of the day previous to operation a simple vaginal douche (two quarts) is given of hot water and soapsuds [green soap is used for this purpose], and the inner surfaces of the labia and the more sensitive parts about the introitus are cleansed with green soap, applied by means of gauze sponges. This is immediately followed by warm 1 to 1,000 bichloride and one per cent. Lysol douches ; after these the vaginal canal is packed with sterilized gauze sponges, soaking in one per cent. Lysol solution. If necessary the nurse introduces a Sims speculum for this last procedure. This packing of the vaginal canal must be at times omitted, especially in unmarried women, on account of the sensitiveness of the parts. These sponges are left in the vagina until one hour before the operation, when they are removed and a warm 1 to 1,000 bi-chloride douche given. The vulva is then covered with the compresses wet with a 1 to 3,000 bichloride solution, as previously mentioned.

PREPARATION OF THE BOWELS.

On the morning of the day previous to operation a laxative is given (preferably pulv. glyc. co., 3 ij.), which is repeated late in the afternoon, if not effectual.

Early in the morning on the day of operation plain soapsuds enemata are given (two quarts each) until the returned fluid is clear (as a rule several have to be given). Nothing more is done to the lower bowel after this.

Bladder.—If the patient has been passing an average quantity of urine at regular intervals on previous days, and passes a sufficient quantity two hours before the time set for her operation, the bladder is not ordinarily catheterized. In patients with large tumors, however, or where any doubt exists as to whether the patient has been able to empty her bladder at this time, the catheter is resorted to with the usual preliminary precautions.

DIET PREVIOUS TO OPERATION.

The day before operation the patient is placed upon soft diet (eggs, custards, broth, etc.), and milk is given to her every two hours till 10 P.M. During the night she is allowed fluids other than milk, and at 10 A.M. (for an afternoon operation) she is given a cup of hot beef-tea. Nothing further is given.

ANÆSTHETIC.

In the choice of an anæsthetic the same general rules have governed here as elsewhere, due regard being paid to the condition of lungs, heart, kidneys, and to the experience of the anæsthetist.

Chloroform is, as a rule, preferred.

Cases.	Ether.	Chloroform.	Chloroform and Ether.	Total.
Vaginal hysterectomy	9	2	.....	11
Abdominal hysterectomy	19	6	1	26
Vagino-abdominal hysterectomy.....	3	1	.....	4

NOTE MADE AS ARTICLE GOES TO PRESS.—Since the writing of this paper a number of hysterectomies have been performed by Dr. McCosh on patients in his wards at the Presbyterian Hospital. On these Schleich's anæsthetic mixture

has been used. In these patients it has been noticed that the preliminary stage of anæsthesia seems to be attended by less cyanosis, less secretion of mucus, and indeed less distress in general than is the case with ether. But in these respects the mixture certainly has no advantage over chloroform. The patients have reached the stage of surgical anæsthesia in a shorter time than is usual with ether, but the after-effects, especially the nausea, seem to have been fully as great as after ether, certainly much more so than after chloroform. It has yet to be proved that its dangers are less than when pure chloroform is used.

OPERATIVE TECHNIQUE IN THE VAGINAL HYSTERECTOMIES.

In this, the vaginal route, no one method is used to the exclusion of all others. The patient is placed on the operating-table in the lithotomy position, and Dr. F. Tilden Brown's leg-holders and crutch are applied. The nurse having removed the dressing over the vulva, the assistant introduces a Sims speculum into the vagina and cleanses thoroughly that canal with ether, alcohol, and bichloride solution, 1 to 1,000; then withdraws the speculum, and washes off the external genital and buttocks with the same solutions.

The operator now inserts a Sims or modified Simon speculum and seizes the cervix with the volsellum, bringing it well into view. If the cervix appears to be normal and there is no discharge from its canal, lateral retractors are introduced into the vagina, and the dissection is then begun. If there be an ulcerating mass, however, such as is encountered in some advanced carcinoma cases, or if we have reason to believe that the endometrium is the seat of a malignant growth or of inflammatory products which are liable to be discharged into the vagina during the operation, we make use of the sharp spoon followed by the Paquelin cautery, to thoroughly remove such tissues and to disinfect the surfaces, the cautery point being also introduced above, searing both the cervical and corporeal endometrium. The vagina is then again cleansed with a bichloride solution, 1 to 1,000 and the uterine canal packed with iodoform gauze.

The cervix being now kept well in view by traction on the volsellum, the vaginal wall is divided in front and at the sides at its reflection on to the cervix by means of scissors, going wide at least one-half inch of such infiltrated tissues as may be present. The bladder is then peeled back from the anterior uterine wall, partly by the fingers, partly by the aid of scissors, the points of which are kept close to the uterine tissue. If bleeding be excessive at this stage, it

may be controlled either by clamps or by sponge pressure. If the latter method is employed the sponge is stuffed firmly into the wound temporarily, and the surgeon then turns his attention to the separation of the posterior vaginal wall. The mucous membrane of the vagina is here divided at its reflection on to the cervix, and the posterior vaginal wall then dissected back from the uterus. The operator opens through into the general peritoneal cavity behind at this stage or else returns to the anterior part of the dissection, where the oozing will usually have ceased, and opens the peritoneal cavity here first between bladder and uterus above.

Should the oozing in the anterior part of the wound be not controlled by the sponge pressure, a running catgut suture is taken through the cut edge of the vagina and divided tissues. This invariably secures the bleeding points satisfactorily.

The peritoneal cavity having been opened, the finger is introduced and the pelvis explored; the presence or absence of adhesions is noted, the existence of malignant or inflammatory infiltration in the broad ligaments and pelvic glands is accurately ascertained, and the condition of the ovaries and tubes recognized. Through this opening we may be able to bring out the tubes and ovaries and subject them to such careful scrutiny as will enable us to decide what had best be done with them.

A sponge is now introduced into the general peritoneal cavity behind to keep back the intestines from the field of operation and to catch any blood that may accumulate during the removal of the uterus. To it is attached a silk string, which is left hanging from the vagina. If the peritoneal cavity has not been previously opened in front between bladder and uterus in the first part of the operation, this is now done, either by the fingers or by means of a blunt instrument, and the fingers introduced through this opening are made to meet those in the posterior incision by hooking them over the broad ligaments on either side.

The cellular tissue at the base of the broad ligaments in the lateral fornices is next opened into by a few snips of the scissors, and the vessels in this part secured by a ligature, usually of catgut, which is introduced on either side, close to the uterus; the corresponding portions of the broad ligament are then divided between ligature and uterus. From this point the procedure is varied according to the method the operator wishes to pursue. If he desires

to remove the uterus as quickly as possible, or if he wishes to make use of the clamp operation, the broad ligaments are seized by large clamps close to the uterine body, and divided between these clamps and the uterus, it being usually necessary to apply two to three clamps on either side. If the vagina be a roomy one, their application may be made partly by the aid of sight and partly by that of touch; if the vagina be narrow, the clamps are guided to their proper place by the fingers of the other hand, which seize the broad ligament just external to the uterus, thus preventing the implication of the ureter in the grasp of the clamps. Usually the broad ligament on one side is completely divided in this way, and the fundus of the uterus brought out of the vagina before that on the other side is completely severed. By this procedure we may, perhaps, apply the clamps to the remaining portion of broad ligament in a more accurate manner.

If the operator, however, prefers to secure the broad ligament vessels entirely by means of ligatures, these are usually applied in a full curved Martin's needle, the point of the needle being guided and guarded by the fingers that are inside the peritoneal cavity. In these cases preference has been given to silk as a ligature material. It is true that, being non-absorbable, these ligatures are at times the cause of a slight delay in the healing of the wound, but the trifling annoyance arising from their withdrawal, if necessary, or their spontaneous separation later on, seems to be more than compensated by the fact that they may always be relied upon if properly applied. It has seldom been found necessary to apply more than two or three on either side. (If one wishes to leave these ligatures "long," to facilitate their removal this may be done.)

After the removal of the uterus, the raw surfaces left are inspected for any bleeding points. If the clamps or ligatures have been properly adjusted, such bleeding points as are seen will usually be found in the cut edges of the vagina, and these can easily be secured after the tell-tale sponge has been removed by a running catgut suture, which is generally employed to unite the cut surface of the vagina with the cut surface of the peritoneum. At this stage, if clamps have been employed, their number can usually be somewhat diminished by applying a single clamp to those portions of broad ligament which had been included in the grasp of two or more clamps successively during the steps of the operation, and by then removing these first

ones entirely. In this way one or two clamps on either side are often sufficient. Whichever method has been employed, "clamp" or "ligature," an iodoform-gauze tampon is now introduced, its upper end being at the vaginal opening into the peritoneal cavity above, its lower end being at the vulva.

A generous pad of sterilized gauze is then applied to the vulva and kept in place by means of a T bandage.

When there are adhesions in the pelvis, the finger introduced through the opening made in Douglas's cul-de-sac in the early part of the operation, recognizes their extent and character and their relations to the various pelvic contents. It is at this stage that the surgeon is called upon to decide what his further steps shall be. Unless the adhesions be of recent date and easily broken down by the finger, and unless the relations of the various structures be clearly made out as the separation progresses, it certainly seems that the patient is thereby subjected to a far greater risk than that which would arise from the opening of the abdomen in the suprapubic region, and the few extra days in bed, made necessary by the abdominal scar. We can, of course, usually foretell, to a certain extent, in each case, what the conditions are which may be encountered in the pelvis, and the findings at the previous bi-manual examination determine, to a certain extent, the choice of route, but there will always remain a certain number of cases where the operator's judgment will impel him to abandon the vagina after he has ascertained the exact condition of the pelvic contents through the opening in Douglas's cul-de-sac. This may apply as well to such fibroid tumors as seem of a proper size to be removed by the vagina, but which, after the peritoneal cavity has been opened, are found to be closely adherent to surrounding parts high up.

It is on this account that it seems best not to start out with the unalterable determination of removing the uterus through the vagina in these cases, but rather to be guided by the precise condition within the pelvis, as made out by the examining finger introduced through this posterior opening.

The skin of the abdominal wall should be thoroughly prepared in all cases so that the route may be altered at any time should conditions be found necessitating this course.

If the clamp operation has been made use of, the handles of these clamps are tied together with silk, each pair separately, after

the completion of the operation, and are then wrapped in a roll of sterilized gauze.

In two cases (one of pyosalpinx and one of pelvic abscess) the uterus was removed (by "morcellement"), hæmostases being secured by clamps applied to the broad ligaments close to the uterus, the corresponding portions of uterine tissue being then cut away and removed through the vagina piecemeal.

GENERAL REMARKS ON THE COMPLICATING CONDITIONS ARISING
DURING THE VAGINAL OPERATION.

(a) *Hæmorrhage*.—Should this occur it will usually be found to arise either from the cut edge of the vagina or as the result of the slipping of a ligature or clamp from one of the broad ligaments. Hæmorrhage from the former is best controlled if at all general, by a running catgut suture, as previously mentioned; if from the latter, we should try to see the bleeding point, by means of strong artificial light if necessary, and assisted by very slight and cautious traction on the other clamps or ligatures. It is perhaps better in these cases to trust to the application of a clamp rather than to attempt to apply another ligature.

Packing is a hazardous procedure, for we cannot apply much pressure to any bleeding area here. We should therefore not resort to this method to check the bleeding unless as a last resort, when the attempts to find the source of the hæmorrhage have failed.

(b) *The opening into a pus sac during the operation*.—When this occurs, the pus should be promptly swabbed out by sponges introduced into the abscess-cavity above and its walls then cleansed with a sponge wrung out in bichloride sol., 1 to 1,000. The pus in many of these abscesses has been shown to be sterile, but this precaution should always be taken, for one cannot be sure that the case in hand is one of that description.

(c) *Prolapse of the ovaries and tubes into the upper part of the wound*.—When the uterus has been removed, the ovaries and tubes are brought into the wound and inspected. If diseased, they are removed, preferably by ligature, together with such portions of the broad ligament as seem affected. If they are healthy, they are returned into the peritoneal cavity above. Should they show a tendency, however, to prolapse into the wound, they are removed

by ligature. Small ovarian cysts may be brought down outside the vulva; the pedicle is there ligated and then returned.

Such accidents as the opening of the bladder in front, or of the rectum behind, or of the implication of the ureters, or of portions of intestine in clamps or ligatures have not occurred in any of these cases, their avoidance being due to the fact that the operator has in all cases kept close to the uterine body during the various steps of the operation.

OPERATIVE TECHNIQUE IN THE ABDOMINAL HYSTERECTOMIES.

After the usual preparatory cleansing, both of abdominal wall and of vagina, by the assistant, the patient is placed in the Trendelenburg position and an incision made just to the left of the linea alba, starting from just above the symphysis pubes, and continuing upward to an extent varying with the size of the tumor, the incision being made of sufficient size to deliver the mass. In some cases it has been found necessary for this purpose to extend the abdominal incision almost as high up as the ensiform cartilage. When this has been done, the knife has been made to sweep to the left of the umbilical tissues.

On opening the peritoneal cavity two or more fingers are introduced for exploration—the further steps are then dependent upon the conditions found within the abdomen.

(a) *Tumor Cases.*—In these cases the fingers are first swept around the tumor or tumors, liberating by touch alone such adhesions as may be recent and easily detached. If adhesions exist, however, binding the various parts firmly to the tumor masses, it is considered a safer procedure to enlarge the incision upward, if necessary, and by means of lateral retraction of the abdominal wall to obtain a better view of the parts thus involved before the separation is effected. In this way, also, bleeding points may be secured at once. The tumor freed in this way everywhere except at its uterine end is then delivered through the abdominal wound, which, if of great length, is immediately brought together at its upper end by means of silk-worm-gut sutures quickly introduced through all its layers by means of a handle needle. This prevents the protrusion of the intestines at the upper part, and lessens to a small but certain degree the amount of shock to which the unnecessary handling

and exposure of intestinal coils above would contribute. Abundant room is left below to carry on the further steps of the operation.

While the tumor (and uterus) is thus held, if possible, well outside of the abdomen, a large clamp seizes the upper part (perhaps two inches) of the broad ligament of one side external to the ovary and tube ; another clamp, placed near the uterus, grasps a corresponding portion of the same broad ligament close to the uterus, and the portion of the ligament between the clamps is then cut through.

The lower portion of the broad ligament is next seized in a similar way with clamps and divided. The broad ligament of the opposite side is treated in the same manner. Each ligament has thus been clamped and divided almost down to the vaginal junction.

In cases where the tumor (and uterus) is more or less sessile, or where the tumor is intraligamentous, it cannot be delivered outside of the abdomen until the broad ligaments have been divided, and consequently in such cases this division must be accomplished while the uterus is still within the cavity of the pelvis.

The position of the bladder, which is frequently pulled far up into the abdomen with the growth, is now sought for and the organ dissected away if necessary from the anterior surface of the uterus or tumor, the peritoneum being divided an inch or two above its reflection, constituting in this way with the reflected bladder the so-called anterior apron. In a similar way the "posterior apron" or flap of peritoneum is formed by dividing the serous coat of the uterus about two inches above the vaginal junction. The steps of the operation now vary somewhat according as to whether the uterus is to be removed entire or a portion of the cervix left behind. If the former is decided upon, the vagina is opened at one side (with or without the help of a blunt instrument in the vagina as a guide) at its reflection on to the cervix and the incision is then prolonged in a circular manner around the cervix, thus liberating entirely the uterus, which is removed with the attached clamps. The cut edge of the vagina is immediately swabbed with a sponge wrung out in 1 to 1,000 bichloride solution, and the canal itself cleansed by passing a strip of iodoform gauze from above downward throughout its whole extent—this gauze distending the canal somewhat as it is forced down, and removing in this way the vaginal mucus and the

secretions from the uterus which have collected there during the operation.

Considerable bleeding may occur from the small vessels in the cut edge of the vagina, but this is perfectly controlled by the running continuous "over and over" suture of strong catgut which is introduced at this stage, whipping over the raw surface and completely closing the top of the vagina. The peritoneum is not included in this suture. The broad ligaments are now permanently secured with silk ligatures applied under the clamps, which are then removed.

These ligatures are applied by transfixing the ligament, each side being tied separately, and the whole mass is then included in a separate ligature for further precaution.

The anterior and posterior peritoneal flaps are now brought together over the top of the vagina and united by a continuous catgut suture; the cut layers of the broad ligament are also closed by catgut sutures, so as not to leave any raw surfaces uncovered by peritoneum.

The patient is then lowered from her Trendelenburg position almost to the horizontal, and the pelvic field of operation carefully inspected for any oozing points that are likely to start up on account of the change of position. Such bleeding points may usually be secured either by a simple catgut ligature or a running suture of the same material if necessary. Gauze pressure will suffice if the oozing be very slight.

Should it be decided, however, to do a supravaginal amputation, the method of procedure is as follows:

After the broad ligaments have been divided between clamps down to the cervix, and after short anterior and posterior peritoneal flaps have been formed, a conical section is made through the cervix just above the vaginal junction and the uterus removed. The lumen of the cervix is then cauterized with the small point of a Paquelin cautery and a small piece of sterilized gauze tape is passed through the cervical canal down into the vagina, its upper end remaining just within the cervix to act as a drain. If the broad ligaments have been clamped or ligated down to their very base but little hemorrhage will come from the uterine stump. What little occurs is easily controlled by deep sutures of catgut passed in an anterior-posterior direction through the cervical stump. Over this the peritoneal flaps are sutured, and the other steps are then taken

as previously described. The abdominal cavity is now closed without drainage. In exceptional cases, however, where the bleeding has been profuse or where the adhesions deep down have proved extensive and have shown a tendency to ooze, it has been deemed wiser not to close the peritoneum entirely below, but to allow drainage by means of a sterilized or iodoform-gauze tampon, the upper end of which was left just at the vaginal opening into the peritoneal cavity below, the anterior and posterior aprons not being united at this point.

In other cases and for similar reasons it has seemed best to drain the pelvic or abdominal cavities in part by means of the abdominal wound, and a gauze drain has therefore been inserted leading down to raw or oozing surfaces and issuing above through the lower end of the incision, surrounded in the greater part of its length by a cuff of sterile rubber tissue to facilitate its subsequent removal. The edges of the abdominal incision above this drain have then been brought together layer by layer by means of buried catgut sutures, and a few additional silk-worm-gut sutures have been introduced through the skin and muscles.

Where no such drainage has been made use of, the abdominal incision is, of course, closed completely in the same way.

Sterile gauze has been used entirely as an outer dressing and retained by means of strips of adhesive plaster; over this sterilized absorbent cotton is placed and a many-tailed abdominal binder.

(b) *For Prolapse*.—In the prolapse case operated on by the abdominal route alone, it was thought best to do a supravaginal amputation of the cervix and to anchor the stump in the abdominal wall. It was therefore thoroughly cauterized and drained, as previously described, and brought up into the abdominal incision between the anterior and posterior aprons of peritoneum, which were sewed to it, encircling the cervix entirely. This stump was sutured to the muscles of the abdominal wound, which were then closed over it. This method has been found thoroughly effective in curing the prolapse.

(c) *For Septic Uterus with General Septic Peritonitis*.—Where we have a large boggy puerperal uterus riddled with pus foci, and a general septic peritonitis which has spread from it, the chances of saving the woman by any means at our command amount to very little, especially if the patient is first seen at a late stage of the process. This condition existed in Case 41, Table II. Under

these circumstances the most rapid operation seems to offer the best chances of success. The method here performed was the following : With a few strokes of the scalpel the peritoneal cavity was opened above the pubes, and the uterus brought up into the abdominal wound (its fundus reached to the umbilicus). The noose of the *serre-nœud* was applied over the uterus, including both ovaries and tubes, and passed down on the body as far as the level of the utero-vesical fold in front, keeping clear of the ureters on each side. It was then tightened until the constriction was sufficient to control the hemorrhage, and the uterus was severed just above it ; transfixion pins were passed through the stump. The abdominal cavity was now rapidly but thoroughly flushed out with gallons of hot normal salt solution in the usual manner until the return fluid was free from pus and lymph-flakes, and gauze drainage strips were introduced in various directions, the transfixed stump being likewise surrounded by gauze. Before bringing the edges of the abdominal wall into apposition one ounce of magnesium sulphate in a saturated solution was introduced by syringe into the lumen of one of the coils of the ileum, and the puncture closed by a Lembert suture. The uterine stump was thoroughly cauterized with the Paquelin.

It may not be amiss to state here that during these abdominal operations, it has been the custom of the operator to inspect the vermiform appendix in each case, and if it is found diseased, to remove it, the method employed in the treatment of the stump being that of the catgut ligature and cautery (see " Presbyterian Hospital Annual Report, 1897," page 152). In Case 38, Table II., the diagnosis of a complicating appendicitis was made before operation and an appendicectomy performed at the same time. The appendix was inflamed and presented two constrictions.

The rapid growth of a uterine tumor seems in some cases to lead to a thinning and separation of the muscular and aponeurotic fibres of the abdominal wall at some point, followed by a varying amount of hernial protrusion, due, presumably, to the increase of intra-abdominal pressure from the tumor. Cases 15, 16, Table II., presented such hernial bulgings on the left side, just above Poupart's ligament. Case 37, Table II., had an umbilical hernia, apparently from the same cause. These conditions were all rectified by reuniting the divided fibres. (This was done at the same time that the uterus was removed.)

GENERAL REMARKS ON THE COMPLICATING CONDITIONS LIABLE TO ARISE DURING THE ABDOMINAL OPERATION.

(a) *Hemorrhage*.—If the broad ligaments are divided between ligatures during the separation and removal of the uterus, it may well happen that one or more of such ligatures are rubbed off from the constricted vessels either by the hand of the operator or by the assistant's sponges, or that owing to retraction of the pedicles, part of the tissue may pull out of the ligature. The method mentioned in the previous description of the operative technique in the abdominal cases does away, as will readily be seen, with this danger, for the broad ligaments are first clamped, and only ligated later, after the necessary manipulations in the deeper part of the wound have been completed.

All bleeding points which can be seen should be ligated. It will occasionally happen, however, as the result of previous inflammatory changes, that it is impossible to apply ligatures satisfactorily to the broad ligaments, on account of their brittle condition, the ligatures cutting through as soon as applied. In that case the safest plan seems to be to apply such clamps as are needed, and to leave them on for about forty-eight hours. By wrapping a piece of rubber tissue around those portions of the clamps that are left within the abdominal cavity, the adhesion to them of the surrounding coils of intestine is prevented. This rubber tissue is removed at the same time as the clamps.

As previously mentioned, a continuous catgut suture taken through the severed vaginal wall is the best method of stopping hemorrhage from that source.

A general ooze from the separation of adhesions in deeper parts had best be stopped by gauze pressure; it will usually cease in a few minutes; this gauze may then be gently withdrawn.

Experience has taught that the resumption of the horizontal position may be accompanied by bleeding from the broad ligaments, the severed vaginal canal, or from torn adhesions in the floor of the pelvis, even when the wound has seemed perfectly dry but a few minutes before, while the pelvis was elevated on the Trendelenburg table.

Hence the precaution mentioned of lowering the patient before

the abdominal wound is sewed up, and of leaving a sponge on a holder in the deepest part of the wound, to be removed the last thing before closing up the abdominal incision ; for by this time, should there be any tendency to such hemorrhage, it will have shown itself in the sponge. Should there be more than slight oozing, it is safer to hunt for the bleeding point rather than to trust to its spontaneous arrest, hemorrhage into the peritoneal cavity being insidious and a possible source of future sepsis.

Such accidents as the opening of the bladder in front or of the rectum behind, or the wounding of a ureter, have not been encountered in any of these cases, the usual rules for their avoidance having been carefully followed. In one case a small rent in the serous coat of a loop of intestine was made while separating the adherent uterus from it. This was remedied by a fine catgut suture through the divided edges of the torn membrane.

OPERATIVE TECHNIQUE IN THE "VAGINO-ABDOMINAL" ROUTE.

As previously stated, three out of the four cases done by this method were started as vaginal hysterectomies ; after the opening of the general peritoneal cavity behind, however, it was considered safer, on account of the conditions encountered, to obtain a clear view of the field of operation ; the further steps were, therefore, carried out through an abdominal incision.

For the aggravated case of complete prolapse, with bladder and rectum down and anterior and posterior hernial sacs, the mass outside the vulva had received frequent dressings before operation in order to heal as far as possible the ulcerated condition of the exposed parts. It was then attacked as follows : The cautery was first applied thoroughly to those portions of the mass which had been deprived of epithelium by the inflammatory process, and the parts cleansed as carefully as possible. The enormously thickened vaginal wall was then incised in a circular manner around the cervix at the site of its reflection, the bladder pulled back from the uterus as far as the utero-vesical fold, the rectum dissected back in a similar manner, and the lower portions of the broad ligaments ligated and severed between ligatures and uterus ; the peritoneal cavity was not opened, however, during any of these proceedings. The parts were then again thoroughly cleansed, so as not to infect the perito-

neum when opened later from above. (All this was done entirely outside the vulva.)

The patient was now placed in Trendelenburg's position and the abdomen opened above the pubes. Traction on the uterus from above exerted by means of a volsellum inserted into the fundus, combined with pressure on the mass outside the vulva, brought the uterus back into the pelvic cavity, where the broad ligaments were divided in the usual manner.

The only remaining tissues to be severed now were those portions of peritoneum which had not been cut through in the anterior and posterior incisions made from below in the first part of the operation. They were divided from above, and the uterus removed. The vaginal cylinder was now drawn upward and the anterior and posterior aprons of peritoneum united around it by suture to the parietal peritoneum of the abdominal wound, thus closing the peritoneal cavity entirely. The cut edge of the vagina was then sutured into the muscular tissues in the abdominal incision, thus opposing an effective barrier to further hernial protrusion.

GENERAL POST-OPERATIVE TREATMENT.

Shock following the operation is best treated by the application of heat to the surface of the body, elevation of the foot of the bed, stimulation with strychnine, hypodermatically, and hot water and coffee by rectum. If there has been considerable blood lost, normal salt solution is introduced slowly into one of the veins in amount from that of one pint to two quarts, according to the quantity of blood lost. This solution is introduced at a temperature of 104°–105° F., the patient usually rallying rapidly as a result of this treatment.

Restlessness and *Pain* coming on in the evening of the day of operation have been treated by an enema of

℞. Sodium bromide.....	3j.
Spts. frumenti.....	℥j.
Aquæ.....	ad ℥iv.

This has been repeated during the night if necessary. If of no avail, resort has been had to morphine, hypodermatically, but only in small doses, and then only when it is absolutely necessary. The

passage of the rectal tube has often quickly dissipated such pain as has arisen from retention of gas. A simple warm enema has in many cases had a similar effect.

Catheterization.—Patients are usually catheterized for twenty-four hours. After that they are encouraged to pass their water themselves. Unless some pain is then experienced as a result of their inability to do so, they are allowed to go for fourteen to sixteen hours, and a hot bed-pan is then placed under them. This was found to be of use in about one-third of the cases. Failing this, they are catheterized. Less trouble is, as a rule, experienced in the vaginal hysterectomies than in the others, for these patients are allowed to turn over in bed almost from the start, and it is found that by doing so these patients are better able to pass their water themselves.

Vomiting.—When the vomiting from the anæsthetic has been in excess, the stomach has been washed out with marked relief. In the case of persistent vomiting, especially if associated with the slightest signs of sepsis, the stomach has been similarly washed out, and calomel (grains three to five), or salts, dissolved in water, then introduced through the tube to secure prompt catharsis. Rectal enemata containing bromide of Na have also been found effective in lessening the vomiting.

Diet Following Operation.—If the nausea and vomiting following the anæsthetic have been trifling or absent, nothing is given by mouth for about twelve hours (during the interval, however, the mouth and lips are kept moist and the feeling of excessive thirst thereby diminished by the application to them of small pieces of gauze wrung out in cold water and renewed every few minutes); one-half ounce of hot water is then allowed by mouth every hour for three to four doses. If no vomiting results, one-half ounce of clear coffee is then given and the patient placed upon fluids (beef-tea, chicken-broth, tea, or coffee, but no milk) for about three days, if conditions remain favorable. After the bowels have moved, the patients are allowed an increased quantity of these fluids, and milk is added, and by the end of the first week they are on soft diet (custard, eggs, oysters, etc.), and in three or four days more they are placed on the regular ward diet.

The above applies to those cases which progress uninterruptedly toward recovery; patients having daily rises of temperature to any extent are kept on their fluid diet as a rule until such fever has prac-

tically disappeared, when they are cautiously allowed on soft, then on regular, diet.

Bowels.—In uncomplicated cases the bowels are usually moved on the third day; preference being given to one-quarter grain of calomel every hour for eight doses. If there is no result two hours after the last dose of calomel is taken, one-half ounce of Rochelle salts is given, and if there be still no result from this in two hours more, a plain rectal enema (two quarts) is administered. This is usually effective.

Position in Bed, Time in Bed, etc.—For the abdominal and the vagino-abdominal cases the usual rules applicable to cœliotomies concerning the patient's liberty to move in the bed, to turn on their side, and the time when they may be allowed to sit up in bed, and to get on their feet, etc., were carried out, the time when each of these steps, in turn, was considered safe for the patient being regulated in each case by the method of closing the abdominal wound followed at the time of the operation and its subsequent behavior, as well as by the patient's general condition. In the vaginal cases, the patients were allowed to turn on their side from the start when attempting to pass their water, this being preferred to catheterization when possible. These cases also were allowed, in the absence of complications, to sit up in bed on the sixth or seventh day, and to be out of bed three or four days later.

DRESSINGS.

Vaginal Hysterectomies.—If clamps have been left on, they are taken off at the end of forty-eight hours. The vaginal tampon of iodoform gauze is usually removed on the third or fourth day, and is followed by a boric-acid douche. This douche is not repeated unless there be a vaginal discharge. If this persists in cases where silk ligatures have been used, it is well to introduce a speculum before the patient leaves the hospital, and by gentle traction to remove such ligatures as can be seen above.

Abdominal and Vagino-abdominal Hysterectomies.—In these cases, where the pelvic or abdominal drain has been made use of and brought out through the abdominal incision above, it is usually removed in non-septic cases on the third day (it comes away easily on account of the rubber-tissue cuff surrounding it), and

the parts are allowed to come together below. In septic cases the drain is removed and a smaller one applied at each dressing, the time of the first dressing and the frequency of the later dressings being regulated by the individual conditions in each case. If vaginal drainage has been employed, the tampons are dealt with and the procedures carried out in the manner mentioned above under "vaginal hysterectomies."

The silk-worm-gut sutures are removed from the abdominal wall usually about the tenth day, and the scar, which has healed by primary intention, receives a protective dressing of a few layers of sterilized gauze for a few days longer. In all cases the sterile gauze-pads applied to the vulva at the completion of the operation are renewed by the nurse as often as may be required. For the first forty-eight hours she inspects these pads carefully for any signs of hemorrhage that may occur; also for the first few hours after the clamps have been removed, in cases where they have been used.

TREATMENT OF THOSE SPECIAL SYMPTOMS THAT WERE ENCOUNTERED AFTER OPERATION.

(a) *Suppression of Urine* (Case 19, Table II.).—This complication occurred in a patient upon whom an abdominal hysterectomy was performed for large sarcoma of uterus. Following the operation, she passed an average of from five to ten ounces a day, containing much albumin and many casts. In spite of treatment directed toward the kidneys, she gradually sank and died on the thirteenth day of uræmia. The wound was perfectly clean. Her bowels had moved well on the second day, and thereafter regularly. (She had chloroform as an anæsthetic.)

(b) *Septic Symptoms*.—*a. From the abdominal or vaginal wound*: These were met by local treatment of the wound itself, wet dressings or vaginal douches repeated, removal of infected sutures, if any present, and thorough drainage of abdominal wound. *b. From septic peritonitis*: The means employed before the operation and continued after it were: Stimulation—whiskey by mouth or rectum in generous doses—strychnine, atropine, nitroglycerine hypodermatically; gastric lavage and bromides by rectum for the vomiting; prompt catharsis—the agents being introduced through the stomach-tube if necessary.

NUTRIENT ENEMATA.

B. Egg	i.
Sarcopeptones.....	3 ij.
Na Cl.....	gr. xx.
Spts. frum.....	3 j.
Pept. milk.	ad f 3 iv.

At 98°–100° F. every six hours, and cleansing enema once a day.

Distention was combated by the rectal tube, large enemata, and prompt catharsis.

(c) *Shock from Hemorrhage*.—This was encountered in a marked degree in one patient. She had already lost much blood through her metrorrhagic attacks before her operation. The intravenous infusion of salt solution previously mentioned was quickly effective. The patient rallied immediately, and progressed slowly but satisfactorily toward recovery without further symptoms.

(d) *Pulmonary Embolism*.—One patient, Case 33, Table III., with endocarditis. She bore the operation fairly well, and was doing nicely following it. The bowels had moved on the second day, and again on the fourth, when she suddenly developed the symptoms of pulmonary embolism and died in a few hours. Warmth to the body, perfect rest, and hypodermatic stimulation were resorted to.

(e) *Acute Mania*.—One patient, Case 15, Table II., developed acute mania on the sixth day after her operation (abdominal hysterectomy for fibroma). This mental condition persisted for about fourteen days, then gradually subsided. Restraint and sedatives were used. She recovered perfectly.

(f) *Pleurisy*.—A slight dry pleurisy developed in one patient. It subsided, however, of itself in a few days.

(g) *Bronchitis*.—Bronchitis developed in one patient, presumably from the anæsthetic. It was slight, however, and did not require active treatment.

AFTER-TREATMENT, ETC.

Before leaving the hospital, patients are recommended to abstain from heavy work for a few months (lifting, etc.), and simply to use douches should there remain a slight vaginal discharge.

Patients are often desirous of wearing an abdominal belt after their departure from the hospital. A fleshy woman with a pendulous abdomen may derive considerable comfort from such a belt,

owing to the support which it furnishes. For the prevention of a hernial protrusion, however, through an abdominal scar, such a belt is of more than doubtful efficacy. Its use for this purpose, therefore, is seldom recommended.

Patients from whom malignant growths have been removed are advised to return from time to time for inspection.

THE FIBROID TUMORS.

There were 23 cases of fibroid tumors of the uterus. In 10 of these the growths were of the intramural, in 8 of the intramural and subperitoneal, in 3 of the submucous, intramural and subperitoneal varieties.

The average age at which these fibroid growths began to give symptoms noticed by the patient was between thirty-seven and thirty-eight years. The youngest patient was twenty-seven years of age, the oldest sixty. Of the 23 patients, 5 were single. Nine were married but had never been pregnant, 9 had borne 1 or more children. The longest time any patient had carried her tumor before resorting to operative relief was eight years, the shortest five months. The average time that the tumors had existed before operation was three years. Those tumors which had acquired the largest growth in a short time were removed from patients under thirty years of age, the largest pure fibroid being in a woman of twenty-nine, whose symptoms dated back two years. In this case the abdomen was almost entirely filled with the mass, a soft fibroid.

Menorrhagia was present in 6 cases, menorrhagia and metrorrhagia in 7, those having the submucous fibroids suffering from their metrorrhagia in the most pronounced way.

Of the 18 women who had intramural or intramural and subperitoneal growths, 9 had neither menorrhagia nor metrorrhagia symptoms, but in them there were present either pressure symptoms, a rapid growth of the tumor, or intestinal and bladder disturbances, incapacitating them from active work. Bladder symptoms existed in about one-third of the cases.

These fibroid tumors were all removed by the abdominal or vagino-abdominal route. This was made necessary either by their size and situation, or by the presence of complicating intrapelvic or abdominal conditions which rendered this course the safer one.

In 6 of the 23 cases numerous adhesions were encountered. In

the other 17 they were few or absent. Fluid was found free in the general peritoneal cavity in 2 patients; one of these (Case 4) was a case of large pure fibromata. In the other (Case 19) the fibromata had undergone sarcomatous changes. Calcareous degeneration in the tumor was noticed in 1 case, a woman of fifty-three, who had carried her neoplasm for at least six years.

Three patients had complicating hernia. Two of these (Cases 15, 16) were hernia of the tissues in the inguinal region; the other (Case 37) was an umbilical hernia. After the removal of the tumor the separated muscles were reunited.

In one case a complicating appendicitis was diagnosed before operation. The diseased appendix was removed and the patient made an excellent recovery.

The general peritoneal cavity was closed entirely after the removal of the tumor in 18 cases. In the other 5 drainage was used on account of the number of adhesions that had to be separated (in 1 case also on account of the persistent oozing in the depths of the wound).

One patient suddenly developed acute mania on the sixth day after operation. This condition persisted for about fourteen days; it then gradually subsided. The patient recovered perfectly.

Two of these cases of fibroid tumors presented points of special interest (Cases 18 and 19). In both of them the fibroid growths had undergone sarcomatous changes. The ages of these patients were respectively forty-five and fifty. In both the primary fibroid growth was of the intramural variety, the area of sarcomatous change being either directly continuous with that of the fibroid tumor (Case 18) or situated at the centre of the fibroid growth itself (Case 19) (see pathological report of both these cases).

A deduction might be offered from a consideration of these 2 cases, that a panhysterectomy would seem advisable in all fibroid tumors of the body of the uterus that are treated by removal on account of the possibility of sarcomatous changes having already occurred in some part of the tumor; and that all fibroid tumors which do not receive operation should be carefully watched and removed on the first sign of clinical malignancy.

Of the 23 cases of fibroids, 21 recovered and 2 died; of the latter 1 was septic before operation but died of nephritis and shock, the other of pulmonary embolus complicating endocarditis.

THE MALIGNANT TUMORS.

In considering the cases of malignant tumors of the uterus recorded in this report, it may be said that the truth of the statement is here borne out, that while the microscope is often of distinct help in doubtful cases, and especially with regard to the advisability of an operation in any given case, still a diagnosis of malignancy made in such cases on clinical grounds is sometimes of more value to the surgeon than the microscopical findings; for the section or curettings removed for purposes of diagnosis, even if of ample size, and selected from what seem to be invaded structures, may fail to show the characteristic changes; should the surgeon be inclined to rely upon the microscope alone, a fatal delay may thus be allowed to occur in a case which otherwise might have been cured at an early date.

Thus in Case 19 the sarcomatous area being in the centre of the fibroid growth would escape detection, for here a preliminary curetting, even if thoroughly performed, would fail to remove any particles of the growth.

The malignant tumors of the uterus for which a hysterectomy was performed were: carcinomata, 2; malignant adenomata, 2; sarcomata, 3.

The respective ages of these patients, with other points of interest, are recorded in brief in the following table:

	Ages.	Single.	Married.	Number of Children.	Number of Miscarriages.	Location of Tumor.	Notes.
Carcinomata...	54	....	M	(?)	(?)	Cervix.....	Menopause three years ago. For several months bloody vaginal discharge.
	31	....	M	4	1	Cervix.....	Miscarriage one year ago. Since then foul vaginal discharge.
Malignant Adenomata	49	....	M	3	(?)	Corporeal endometrium.	Symptoms began (three years ago) one year after menopause. Bloody vaginal discharge, backache, anæmia.
	35	....	M	....	....	Body of uterus and upper third of endometrium.	Gradually increasing menorrhagia for last twelve years.
	40	....	M	2	....	Body of uterus.	Free metrorrhagia (requiring packing, etc.) only six weeks before operation.
Sarcomata....	45	....	M	1	....	Body of uterus and continuous with fibroids.	Metrorrhagia for eleven months. Also shreds in discharge.
	50	S	....	....	....	Body of uterus; in centre of fibroid.	History uncertain. Irregular menstruation.

Both the carcinoma cases were removed by the vaginal route.

The malignant adenomata were removed: 1 by the vaginal route, the other by the abdominal, on account of the size of the tumor.

One of the sarcomata was removed by the vaginal, the other 2 by the abdominal route.

These patients all recovered except 1 of the sarcoma cases, who died of uræmia on the thirteenth day.

THE CASES OF PROLAPSE.

Hysterectomy was performed three times for prolapse, once by the vaginal, once by the abdominal, and once by the vagino-abdominal route.

In the first case of prolapse a hysterectomy was decided upon on account of the appearance of the endometrium, which was strongly suggestive of malignancy (see pathological report, Case 9).

In the second (Case 11), in addition to the prolapse, there was an ovarian cyst, which was made out before operation. The abdominal route was chosen here as it was desired to bring the stump of the cervix up into the abdominal wound to cure the rectocele and cystocele.

In the third case a large uterus hung outside the vulva, half way to the patient's knees; the bladder in front and the rectum behind had been dragged out by the descent of the uterus, and there were large anterior and posterior pouches filled with intestines. The whole mass was ulcerated and gangrenous. The methods employed in this case have been previously described under "operative technique in the vagino-abdominal route."

The first 2 of these cases made perfect recoveries. The third, in spite of the previous preparations of the sloughing and gangrenous parts, which was carried out in a most thorough manner, and the scrupulous attention on the part of the operator to keep all the inflamed surfaces as aseptic as possible during the operation, developed symptoms of sepsis and died on the fourth day.

THE PYOSALPINX CASES.

Hysterectomy was performed twice for pyosalpinx, once by the vaginal, and once by the abdominal route.

In the first case the uterus, ovaries, and suppurating tubes were all matted together into a mass of unusual hardness. They were removed by morcellement.

In the other case the conditions were somewhat similar, but the mass was much larger and the adhesions more numerous. It was thought wiser to remove it from above. Both these cases did well.

FOR POLYPOID DEGENERATION OF THE ENDOMETRIUM.

One case. In this patient both ovaries and tubes had been removed five years before for double pyosalpinx. The intra-uterine growth was the cause of severe pain and of an exceedingly irritating vaginal discharge; she was forty-one years of age. It was, therefore, thought best to remove the uterus. The vaginal operation was done, clamps being used. (A small abscess which formed in one of the labia kept the patient in bed a few days beyond the usual time. Otherwise the recovery was uneventful.)

PERSISTENT DYSMENORRHOEA FOLLOWING OFT-REPEATED ATTACKS OF PELVIC PERITONITIS, UNRELIEVED BY OÖPHORECTOMY AND OTHER FORMS OF TREATMENT.

One case (12). She had experienced a large number of attacks of pelvic peritonitis at frequent intervals with increasing dysmenorrhœa, and had resorted to all sorts of treatment without avail. Oöphorectomy performed in Boston eight years previously had not given her any relief. The pelvic contents were all bound down by old tough adhesions, which were most numerous and unyielding in the neighborhood of the body of the uterus. A hysterectomy was considered as offering her the best chance of relief. A supravaginal amputation of the cervix was done and the peritoneal cavity closed above and below without drainage. She made a good recovery and has been entirely relieved of all her former bad symptoms.

THE ENDOMETRITIS CASES THAT WERE CLINICALLY MALIGNANT.

Two cases. In the first, the patient, aged thirty-four, had been losing flesh and strength for some time. The uterus was large, the cervix hard and nodular, and there was a blood-streaked vaginal discharge. A careful examination of all the organs failed to reveal

any other cause for her general condition. It was therefore thought wisest to remove the uterus. This was done by the vagina, the clamp operation being performed. The patient was up on the eleventh day and left the hospital on the sixteenth day, having made a perfect recovery. Although the pathologist's report (Case 29) does not indicate the existence of cancer in the sections of this uterus that were examined, the clinical features of the case were sufficient indication for the operation.

In the other case, the operation was performed on a woman, aged forty-one, for persistent metrorrhagia. The usual methods of treatment had been employed, followed by a thorough curetting—all without avail. The patient continued to lose ground. Vaginal route, clamp operation; out of bed on the tenth day and left the hospital on the twentieth day. Perfect recovery. The pathological report is of interest (Case 37).

FOR MENSTRUAL INSANITY.

The patient, a married woman, aged twenty-nine, was practically insane during her period from the pain that she suffered; all known methods of treatment had been employed in the case, but without avail. A panhysterectomy, with removal of the ovaries and tubes, was performed by the vaginal route, clamps being used. She was up on the fourteenth day and left the hospital on the twenty-first day. Excellent recovery. (This patient has been under observation since then; all her nervous symptoms have been relieved by the operation.)

FOR PELVIC ABSCESS.

One case. This patient had suffered in the last four years from four pelvic abscesses, matting everything together in the pelvis. She was septic before operation, and required considerable stimulation. Several abscess-cavities were drained by the vagina, and portions of the uterus removed by morcellement for better drainage. She succumbed to her septic condition.

FOR PUERPERAL SEPTIC METRITIS WITH GENERAL SEPTIC PERITONITIS.

One case. The method employed in this case has been mentioned under this heading. The uterus was riddled with pus, and

the septic peritonitis was too far advanced. Death followed within twenty-four hours.

PATHOLOGICAL REPORTS ON THE SPECIMENS REMOVED.

Case 1.—The cavity just above the internal os divides; one part resembles the normal cavity of the body of the uterus, the other is a little dilated, and on its wall is a soft, brownish-gray thickening about $1 \times \frac{3}{4} \times \frac{1}{4}$ inch. . . . Sections from the soft mass in the body of the uterus show masses of spindle cells; . . . there are a few giant cells. . . .—*Extract from* DR. THACHER'S *report*.

Case 2.—Uterus appears about normal, but small. Hanging from fundus into cavity of body is a soft polypus. Microscopical examination: Mucous polyp. No cancer found in sections of cervix.—THACHER.

Case 3.—Cluster of large fibroids; weight, $29\frac{1}{2}$ ounces; length of uterine canal, 5 inches; ovaries rather fibrous.—THACHER.

Case 4.—Clusters of large fibromata; weight, 106 ounces; uterine canal, 5 inches long; ovaries enlarged and cystic.—THACHER.

Case 5.—A nodular mass about $5 \times 4 \times 3$ inches in dimension involving the uterus and surrounding it. Some of the nodules are calcareous. Microscopical examination: Fibromyoma.—THACHER.

Case 6.—Fibroid tumor of uterus; weight, $47\frac{1}{2}$ ounces; cervix normal; body distended by submucous fibroid attached to fundus $2\frac{1}{2}$ inches in diameter; several fibroids about lower part of body up to $1\frac{1}{2}$ inches in diameter; one $6 \times 4 \times 4$ inches attached by soft pedicle to left part of back of body; ovaries slightly enlarged; tubes appear normal.—THACHER.

Case 7.—Specimen weighs 16 ounces; uterus, normal size; to it are attached several large fibroids, mostly subserous and pedunculated; one prominent submucous nodule 1 inch in diameter. Microscopical examination: Fibromyoma.—THACHER.

Case 8.—Large, hard, spherical mass 8 inches in diameter. The uterine cavity is spread out about $1\frac{1}{2}$ inches from the surface and to nearly the area of the hand. Microscopical examination: Fibromyoma.—THACHER.

Case 9.—Uterus and appendages: Ovaries fibrous, one contains a fibroma $\frac{3}{4} \times \frac{1}{2} \times \frac{1}{2}$ inches. Tubes normal. Uterus: Cervix lacerated, fibrous, mucous membrane of body red, thick, soft. Cervical canal, surface uneven. Microscopical examination: Mucous membrane of body of uterus thickened, glands irregular, interglandular tissue proliferated, in some parts extravasated blood. Mucous membrane of cervix: Glands irregular, slight proliferation of small cells. Diagnosis: Chronic endometritis.—THACHER.

Case 10.—The tumor removed seemed to be made up of a mass of fibroid tissue occupying right broad ligament, and connected slightly, if at all, with uterus by direct continuity of fibroid tissue. Mass irregular, nodular, presenting on section of the nodules typical soft fibroid appearance. Both ovaries somewhat cystic, size about normal. Both tubes about normal. No fibroids made out in body of uterus. Microscopical examination: Not recorded.

Case 11.—Body of uterus with a number of fibroid tumors in the wall. One ovary is a cyst the size of a goose-egg filled with clear fluid. Other ovary has a small cyst at one end and a corpus luteum $\frac{3}{4}$ of an inch in diameter at the other. Tubes normal.—THACHER.

Case 12.—The uterus was small. Microscopically, the changes were those of chronic “endometritis corporis uteri.”

Case 13.—Case of prolapse.

Case 14.—Pyosalpinx case. No report.

Case 15.—After the operation, incision of the uterine tumor showed it to be a large fibroid occupying the posterior and left side of the uterine wall.

Case 16.—A fibroid in the posterior wall of the uterus, forming with the body of the uterus a hard spherical mass 4 inches in diameter. The uterine cavity is flattened out in the anterior portion $\frac{3}{8}$ of an inch from the surface. The cervical canal is $1\frac{1}{2}$ inches long. The cavity of the body is 4 inches long.—THACHER.

Case 17.—Report is wanting. It was an intramural fibroid.

Case 18.—Uterus: One large mass, $2\frac{1}{2}$ inches in diameter, in wall, which looks like an ordinary fibromyoma. Projecting into the cavity of uterus are several small nodules of soft consistence and gelatinous appearance on section. These nodules lie on the same side of the cavity as the fibroma and appear to be continuous with it. Microscopical examination: Sections of the soft nodules show the structure of sarcoma, the cells being moderately large, in greater part spindle-shaped. Masses of this tissue invade the neighboring fibromuscular tissue. Pieces from vagina and cervix show in places some inflammation but no further lesion.—THACHER.

Case 19.—Uterine tumor; weight, 9 pounds 3 ounces. A mass of large fibroids, in some parts rather gelatinous, at the centre of the mass a large bloody, partly yellow, partly gray, soft area. Microscopical examination of the soft parts: Necrotic areas, areas of small round-cell sarcoma, areas of spindle-celled sarcoma, very vascular in parts. Diagnosis: Uterine fibromyomata with sarcomatous areas.—THACHER.

Case 20.—Uterine fibroids and cysts of broad ligament.—THACHER.

Case 21.—Uterus, $5 \times 2\frac{1}{2} \times 2$ inches. Attached to the fundus is a subperitoneal fibroid 3 inches in diameter. A few smaller fibroids. Ovaries contain some small cysts, some of them bloody. Tubes appear normal. Small clot in uterus. Microscopical examination: Clot crowded with leucocytes and containing some uterine mucous membrane. Fibromyoma inflamed at mucous membrane.—THACHER.

Case 22.—Microscopical examination: Masses of irregular glandular, *i.e.*, adenomatous tissue. From the profusion and the irregularity of the hyperplasia, and from the occasional presence of dense connective tissue and smooth muscle, I judge it to be a malignant adenoma.—THACHER.

Case 23.—From uterus, cyst-wall and contents. Some firm gray tissue in the cervical wall. Microscopical examination: Cervix, cancer; scraps, cancer; cyst contents, probably cancer.

Case 24.—In the anterior wall of the uterus an ovoid tumor, 9 inches in its

greatest diameter, composed of firm, pale-pinkish and yellowish tissue. Uterine cavity, 4 inches in length. Weight of tumor, 89 ounces. Microscopical examination : Fibromyoma.—THACHER.

Case 25.—Fibromyoma. An area of necrosis surrounded by hemorrhages and a few groups of leucocytes.—THACHER.

Case 26.—There is a tumor in the anterior wall of the uterus 5 inches in diameter, apparently fibrocystic. Uterine canal measures about 5 inches. Microscopical examination : Fibromyoma.—THACHER.

Case 27.—From uterus and adnexa. Uterus, $4\frac{1}{2}$ inches long. A little fluid. Each tube enlarged to about 1 inch in diameter, walls thickened, lumen contains Ovaries slightly enlarged, all intimately bound together. Microscopical examination : Salpingitis ; endometritis, especially in cervix. Abundant gonococci found in smears of the fluid in tubes.—THACHER.

Case 28.—Uterus, $3\frac{1}{2}$ inches long. Cervix irregular ; one flat nodule consists of grayish translucent tissue. Microscopical examination : Carcinoma. From the abundant mitoses it was probably rapidly growing.—THACHER.

Case 29.—From uterus. Microscopical examination : Simple inflammation ; no cancer. (Sections examined from various parts of cervix as well as from the body.)—THACHER.

Case 30.—From uterus. Microscopical examination : Fibromyoma. The tissue is necrotic in places. In some parts the muscle-cells are quite small and closely crowded.—THACHER.

Case 31.—Simple inflammation, no evidence of malignancy.—THACHER.

Case 32.—Uterus, tubes, and ovaries removed for menstrual insanity. Report is wanting.

Case 33.—From uterus. Uterus measures $3\frac{1}{2} \times 2 \times 2$ inches. A fibroid, $3 \times 2\frac{1}{2} \times 2$ inches, lies in one broad ligament. Several smaller fibroids of the uterus, subperitoneal, intramural, and submucous. Microscopical examination : Fibromyomata.—THACHER.

Case 34.—Uterus, $6 \times 4\frac{1}{2} \times 3$ inches. Cervix, $1\frac{1}{4}$ inches. The uterine cavity dilated and nearly filled by a rather soft, somewhat gelatinous, mass, which hangs down from a wide attachment over the upper third of the lining. The gray gelatinous material is found to be invading the muscular wall ; over one of the cornua it is found to come within a millimetre of the peritoneal surface. The growth on section appears to consist of fibrous white trabeculae between grayish gelatinous islands. Microscopical examination : Malignant adenoma. Tissue like that of the corporeal endometrium is found in islands deep in the muscle.—THACHER.

Case 35.—From uterus, tubes, and ovaries. Ovaries, $2\frac{1}{2} \times 1\frac{1}{4} \times \frac{1}{2}$ inches, and $2 \times 1 \times \frac{1}{3}$ inches, fibrous, a little oedematous. Several small cysts. Tubes normal. Large tumor involving the uterus, $8 \times 9 \times 4$ inches on section, has the appearance of a rather soft fibroid. Microscopical examination : Sections of the tumor show a connective-tissue structure, in places extremely rich in oval cells, in places loosely fibrous. The richly cellular parts are often encircling the blood-vessels. The vessel-walls are often very thick. Soft fibroid.—THACHER.

Case 36.—From uterus. The mucous coat is a little thickened. The line be-

tween the mucous and muscular coats is not entirely even, and there are some dippings in of the glands, but not enough to determine a diagnosis of malignancy.—THACHER.

Case 37.—Uterine tumor, $8 \times 6 \times 6$ inches. Uterine cavity, 7 inches long; irregular. Tubes and ovaries normal. One ovary contains corpus luteum. Tumor consists of cluster of firm fibroids of all sizes up to $3\frac{1}{2}$ inches. Microscopical examination: Myoma. (The tumor weighed seven and one-half pounds.)

Case 38.—Uterine cavity, 3 inches. Several fibroids, intramural and sub-peritoneal, the largest $1\frac{1}{2}$ inches in diameter; one in front of the internal os, the others chiefly behind and at fundus.

Case 39.—Uterine cavity measures $4\frac{1}{2}$ inches. Numerous fibroids at fundus, forming a mass 6 inches laterally, 4 inches antero-posteriorly, besides a pedunculated fibroid attached to the anterior upper portion of the mass already described, and measuring 6 inches laterally and 3 inches in the other directions. The ovaries are a little enlarged and contain a few cysts.—THACHER.

Case 40.—Report is wanting. The tumor was a fibroid.

Case 41.—Uterus, $6 \times 5 \times 3$ inches. All the appendages considerably enlarged. Uterine wall, $1\frac{1}{4} \times 2$ inches in thickness. The lining is uneven; some yellow spots in and just beneath the surface. Microscopical examination: Very marked inflammation, simple; cultures show pure growth of streptococci from both intra and extra-uterine cultures.—THACHER.

XVI.

INTERMUSCULAR OPERATIONS FOR APPENDICITIS, WITH APPLICATION OF THE METHOD TO CASES IN WHICH PUS WAS SUSPECTED AND FOUND.

BY CHARLES K. BRIDDON, M.D.

THE Annual Report of the Presbyterian Hospital, 1897, gives ninety-nine operations for appendicitis, presumably half of which occurred in my service, and out of those I have selected fourteen in which the intermuscular operation was done according to the method of McBurney, extending it to cases in which extensive adhesions, or the presence of pus, called for manipulations over a large area. I was surprised to find how, by sliding the opening with suitable retractors, it could be shifted in different directions, and in the cases in which I have selected this method, I have not in a single instance found it necessary to cross-cut the fibres of the muscles. I may also say that as far as I could see, the wounds have drained as well as in the cases done in the usual manner. The very great advantages that follow a separation instead of a section of the muscular structures of the abdominal wall must be apparent to those who have much to do with such operations, the danger of hernia, as is occasionally seen after the usual operation, being thus avoided; and from what I have seen of it I am inclined to think it can be used with advantage in quite a number of cases.

CASE I. On the third day of a mild attack of what was regarded by his physicians as one of subsiding appendicitis, patient was suddenly seized with severe vomiting and increase of pain, which extended to left iliac fossa. Three days later was admitted in pretty bad shape. The usual operation was done, evacuating about eight ounces of foul-smelling pus, and after a very careful search, without disturbing adhesions, which appeared to wall in the cavity, the appendix was found and removed. Wound left open. On the ninth

day temperature ran up to 102° F., and continued high until the sixteenth, when an induration was made out just inside the left anterior superior spinal process. This was approached by the intermuscular method, and an abscess situated between the sigmoid flexure and the abdominal wall was opened, giving exit to a considerable quantity of fetid pus. Wound drained well, and with the exception that the convalescence was slow, it was satisfactory, with firm cicatrices on both sides.

CASE 2. Second attack, local and general symptoms subsiding when admitted. On the tenth day, increase of pain and tenderness. Intermuscular operation; small abscess opened. After catharsis, and change of dressing on the fourth day, pulse and temperature came down. Wound drained well, cicatrix firm.

CASE 3. First attack; local pain and tenderness. No elevation of temperature, and no acceleration of pulse. Left hospital the day after, to return in two days with temperature 102° F. and return of local pain. After forty-eight hours, his symptoms having increased, intermuscular operation was done over the mass, which was situate between the crest of the ilium and ribs. There were absolutely no adhesions between the serous surfaces. An opening was made through the apparently healthy peritoneum, and directing blunt dissection behind the mass a small cavity was opened containing foul-smelling pus. The appendix, containing a large enterolith, was situate behind the cæcum. Wound drained well.

CASE 4. Patient in bad shape when admitted; temperature, 103° F.; pulse, 135. A small, under-fed child. Large abscess reaching from iliac fossa to under surface of liver. Intermuscular operation, which did not open the cavity of the peritoneum. Wound drained well, and recovery uneventful.

CASE 5. J. R., aged twenty-three; single; insurance; New York; admitted, February 28, 1897. Patient began to be sick one week before admission with pain in the right iliac fossa, where there was considerable tenderness; vomited also several times; bowels very constipated. Pain remained localized in right iliac fossa, with gradual improvement for three days, when he was attacked with a

very severe fit of vomiting and increased pain, which extended to left iliac fossa, where he also became tender. No chills; slight elevation of temperature. On admission patient looked sick, face was pale and anxious. Abdomen was slightly distended. There was tenderness all over lower half of abdomen, with maximum intensity in right iliac fossa, where there was great muscular rigidity, on account of which no mass could be made out. Patient's temperature was 100° F.; pulse, 108. Diagnosis was at once made of appendicitis with beginning septic peritonitis, and an immediate operation advised and consented to. Chloroform was administered after the usual antiseptic precautions. When anæsthetized, no mass in right iliac fossa could be distinctly made out. Usual appendix incision made, three inches long, opening peritoneal cavity, whereupon there was a gush of foul-smelling pus, about eight ounces in all. This was sponged away. Finger carefully inserted detected adhesions all about the abscess-cavity. The appendix was found, after careful search, without breaking up any of the adhesions, at the bottom of the cavity, bent upon itself, with a very thick fatty meso-appendix. Meso-appendix ligated with catgut and severed from appendix. Catgut ligature about base of appendix, which was removed and stump well cauterized. Iodoform-gauze drains in wound. No sutures used. Aseptic dressing.

Convalescence for a time uneventful. On the second day bowels moved well after small divided doses of calomel. Temperature did not go above 100° F. Was dressed on fourth day for first time, packing removed, wound irrigated and repacked. On the ninth day temperature went up to 102° F. without any discoverable cause. Had slight pain in left iliac fossa. Continued to run a temperature of about 102° F., till on the sixteenth day an indurated area was discovered inside left anterior superior iliac spine, about the size of an egg. Pain here became severer, and three days later diagnosis made of a secondary abscess. Ether was then administered on March 19 and an intermuscular operation performed, the skin incision being three inches long, one inch internal to and on level with anterior superior spine, after separating the fibres of the external and internal oblique and transversalis muscles. Peritoneum opened. Finger inserted downward opened an abscess-cavity, situate between the sigmoid flexure of the colon and the abdominal wall, containing a considerable quantity of stinking pus, which was evacu-

ated; cavity sponged out cleanly. Iodoform-gauze tampons inserted. All symptoms quickly subsided and convalescence rapidly progressed. On the fourth day left-side wound dressed, and to facilitate the drainage by holding the muscles apart, a rubber drainage-tube, wound about with iodoform gauze, was inserted into the cavity. This wound drained thereafter perfectly, and rapidly granulated up from the bottom. On the forty-eighth day after the original operation patient allowed out of bed, and was discharged cured on the sixty-second day, both wounds having healed nicely, there being no tendency to hernial protrusion on either side.

CASE 6. H. P., aged forty-three; single; male; cabinet-maker; Finland. Four months before admission had an attack similar to the present one.

Eight days before admission the patient was suddenly seized with general cramps of the abdomen, which, on the next day, were more marked in the right iliac region. The pain, severe at the onset, was much less for four days preceding admission. There was one chill at the time of the onset, but none since, and he has not been conscious of any fever. Vomiting was persistent for the first day, but there was none after this. He was very tender in the appendix region, and has been very constipated.

On admission to the hospital, on April 3, 1897, his temperature was 98.9° F.; pulse, 120; respiration, 24. Urine contained a trace of albumin, a few leucocytes, but no casts. He was a strong, muscular, heavily built man; tongue heavily coated; heart and lungs normal. His abdomen was soft and not distended; in the right iliac fossa, one inch within the iliac crest, there could be felt a sausage-shaped mass, three inches long, very slightly tender, and freely movable. There was practically no muscular rigidity.

He was placed on a fluid diet, and ice was applied locally in the hope that the acute attack might subside; but at the end of ten days the tenderness was increasing rather than diminishing, and it was deemed best to interfere by operative procedure.

Under ether the abdomen was opened by the intermuscular incisions. The examining finger at once detected a mass to which the omentum was closely adherent. The finger was passed to the outer side of the mass and it was drawn into the wound. In doing this a small opening was made into it which allowed a small quantity of

pus to escape, which was caught on sponges and removed. The mass was then opened and found to be a mass of omentum in which was buried the appendix, which had nearly sloughed through near its base. The stump of the appendix and its meson were ligated with catgut, as was also the diseased omentum; these were then removed and the stumps cauterized. It was not deemed prudent to close the abdominal cavity completely; therefore an iodoform-gauze wick was passed into the wound down to the stumps. A few catgut sutures approximated either end of the incision through the external oblique.

The patient made a straightforward recovery; the temperature remained at 101° F. for four days, with a pulse of 115. Following dressing and catharsis, these fell to normal and remained there during the subsequent course. There was considerable purulent discharge, but the wound was well drained, and on May 22 the patient was discharged with a firm abdominal wall entirely healed.

CASE 7. I. W., aged thirty-six; male; butler; colored; United States. Was in the hospital from September 22 to 26 with a subacute attack of catarrhal appendicitis, characterized merely by localized tenderness on pressure, without vomiting, elevation of temperature, or increase in the frequency of pulse. He left at his own request. On the day after leaving he suffered from a return of pain and tenderness, and was readmitted on the 29th, with temperature 102.4° F., but no acceleration of pulse. Remained under observation for two days, during which time symptoms gradually increased, especially the pain. Physical examination detected a tender mass about the size of an egg, situate altogether above a line drawn from the anterior superior spinous process of the ilium to the umbilicus, lying about midway between the crest of the ilium and the border of the ribs. As the mass presented no evidence of decreasing in size, an operation was advised and accepted.

October 1, under the influence of ether, an intermuscular operation was done, with some misgiving, however, as there could be little doubt as to the probable existence of a circumscribed collection of pus. Incision was made higher up than usual, directly over the mass. On opening the abdominal cavity no intraperitoneal adhesions were found. The smooth serous surfaces could be traced from the inferior and lateral surfaces of the caput to the adjacent normal

membrane. A very dense mass could be felt through the centre of the cæcum, its anterior wall moving readily over it, which was considered to be the appendix bent at an acute angle and lying behind the gut. It was approached by scratching a hole through the peritoneum at a point where it passed from the gut to the abdominal parietes, and pressing the finger cautiously through the loose connective tissue until it entered a cavity situate immediately behind the indurated mass, and gave exit to a small amount of very fetid pus. Considerable difficulty was experienced in isolating the appendix, during which quite a large enterolith escaped. The organ was stripped from its thickened and closely adherent investment, not from choice, but because it peeled off in that way, measuring about three inches. A gut ligature was applied through its base and another secured the mesentery. The stumps were cauterized and a medium-sized rubber tube surrounded with gauze was left in contact with the section, recognizing the probability that a gauze drain alone would suffer such compression by the muscular surroundings as to defeat the purpose for which it was used. In this case the operation was done with as much ease as it would have been done through the usual incision. The opening in the abdominal wall could be shifted by retractors over a considerable area, facilitating the steps of the operation.

Convalescence was uneventful. The wound drained well, and he was out of bed by the 27th.

CASE 8. C. S., aged eight; school-boy; United States. Patient's illness began ten days previously with sudden pain in the right iliac fossa, and considerable tenderness over McBurney's point. These symptoms continued up to time of admission. Vomited slightly the first day, but has not done so since. Bowels had been constipated. Has had fever, but no chills. On admission patient's temperature was 103° F.; pulse, 138; tongue was coated. On examining the abdomen there was no general distention nor rigidity, nor tenderness. In right iliac fossa there is exquisite tenderness, extending inwardly almost to median line, and most marked just inside anterior superior spine and extending up to costal arch from this point. Muscular resistance was so great that it was impossible to say accurately whether a mass existed or not. Patient was prepared for operation, ether administered, and a mass felt extending

from just inside anterior superior spine along the flank to the costal arch. Intermuscular operation was performed, the incision in the skin being one inch internal to the anterior superior spine, this point being over the most prominent part of the tumor. With the edges of the incision well retracted, a good-sized opening down to the peritoneum was secured, on opening which there was a gush of fetid pus from an abscess-cavity whose walls were formed internally by the matted together intestines, and externally by the parietes, the abscess-cavity extending upward to beneath the costal arch. It was not deemed wise to search for the appendix for fear of breaking up adhesions and infecting the general peritoneal cavity. The opening into the abscess-cavity was deemed sufficiently large to afford good drainage, so a rubber drainage-tube, wound around with iodoform gauze, was placed to its bottom. Patient stood the operation well. Convalescence was uneventful. Was dressed on the third day, drainage-tube removed, cavity irrigated with creolin, one-quarter per cent., and drainage-tube and iodoform packing replaced.

Wound dressed every other day; drainage-tube discontinued on the eleventh day, the wound still being packed with iodoform gauze. At time of writing, the twentieth day after the operation, there is a small sinus three inches long, which is kept open by iodoform-gauze drain. Drainage of this abscess-cavity seemed as perfect after the use of the intermuscular operation as it could have been after the use of the ordinary incision, and certainly the patient will finally have a much firmer abdominal wall.

CASE 9. M. K., aged thirty-seven; female; married; housewife; New York; admitted to hospital, September 29, 1896. Patient has always been a neurotic woman. Twelve years ago she was confined to bed by an illness which her physician pronounced to be peritonitis; the only symptom which she remembers of this time is pain which extended all through the pelvic region. This illness was immediately followed by an attack of typhoid fever. She was then well until the birth of her only child, ten years ago. Since the birth of this child she has suffered continually from headache, palpitation of the heart, and backache. Her present complaint dates back four months. Since that time she has had considerable severe pain in the right iliac region, which she locates very definitely at a point two inches to the right and one inch below the umbilicus. She

does not describe any sharp attacks of pain, but during this period has suffered from general malaise and at times has been confined to bed. Her menstrual history is good and regular. On admission it was observed that she was of neurotic temperament. She complains of pain and tenderness in the appendix region. There is evident pain on pressure at the point above described. Vaginal and physical examinations are otherwise negative. Urine is normal. Temperature, 98.8° F.; pulse, 132; respiration, 40. Her symptoms remained unchanged until October 7, when, after the usual clearing out of the bowels with mild cathartics and enemata, she was placed under ether and the appendix removed by the intermuscular operation. The skin incision was four inches in length, with its middle point one and one-half inches within the anterior superior spine. The external and internal oblique and transversalis muscles were opened in the direction of their fibres in the usual manner, the transversalis fascia and peritoneum being cut in the same direction as the opening in the transversalis muscle. Deep blunt retractors were placed in the wound. The finger of the operator was introduced and the appendix easily found and drawn into the wound. It was only one inch in length, but otherwise of normal appearance. A ligature of catgut was tied about it close to the cæcum and it was cut away, the stump being cauterized and returned to the peritoneal cavity. The right kidney and ovary were palpated through the wound and nothing abnormal found. The abdominal wall was closed with buried sutures in the direction of the incisions; the peritoneum and transversalis fascia with continuous catgut; the transversalis and internal oblique muscles and the external oblique each with interrupted sutures of catgut; the skin and deep fascia with interrupted sutures of silk-worm-gut. A small rubber-tissue drain was placed in either end of the skin incision, thus draining the subcutaneous tissue. Sterile dressing and binders were applied.

During the night and day following the operation she had some little pain and was quite restless, and during this time was relieved by three doses of one-eighth grain of the sulphate of morphine administered hypodermically. On the day following the operation her temperature rose to 101.7° F., and pulse to 140. Put on fluid diet.

On the second day her bowels were opened with small doses of calomel, followed by a saline and an enema. Her highest temperature was 100° F.; pulse averaged 130.

Up to the sixth day following operation she had occasional rises of temperature, none over 100.4° F. ; pulse averaged 110. On this day she was put on light diet and the superficial stitches removed, good union having taken place. Following this her temperature and pulse fell to normal, and remained so during her subsequent stay in the hospital.

On the fifteenth day she was allowed to get out of bed, and three days later was discharged with a firm abdominal wall.

The pathologist, on examining the appendix, reported that the microscopical examination showed an absence of the mucous membrane, submucous coat containing many cells in parts as if from sub-acute inflammation.

CASE 10. W. F., male ; aged twenty-five ; married ; elevator operator ; United States ; admitted to hospital, April 27, 1896, with the following history: Patient was perfectly well until four months ago, when he was suddenly, without known cause, seized by an attack of vomiting, followed by cramp-like pains over the appendix point ; there was also exquisite tenderness over McBurney's point. This attack lasted for seven days, and then he entirely recovered his usual health and remained well until two and a half weeks before admission to the hospital, when he had an attack similar to the first, which lasted four days. He was seen by physicians and told that he was suffering from an attack of appendicitis. Since this attack he has been perfectly well, excepting for occasional twinges of pain in the neighborhood of the appendix. He enters the hospital for the purpose of having his appendix removed.

On admission his physical examination is negative ; there is no tumor or tenderness in the appendix region ; temperature, 99° F. ; pulse, 80.

On April 29 the patient was anæsthetized and the appendix was removed by the intermuscular incision. An incision, four inches in length, in the direction of the fibres of the external oblique was made, passing through skin and external oblique muscle. The centre of this incision was on a line joining the umbilicus and the anterior superior spine of the ilium ; the skin and external oblique were then well retracted, and the internal oblique and transversalis muscles opened in the direction of their fibres, nearly at right angles to the incision through the external oblique, by blunt dissection. The

transversalis fascia and peritoneum were opened in the same direction. These structures were drawn apart by deep retractors, at once exposing the ascending colon. The examining finger at once found the appendix, which was bound down by fresh adhesions which were easily separated, allowing the appendix to be drawn out of the wound. The appendix was considerably swollen and there was a small amount of yellowish serum about it, but no pus. The meso-appendix and the base of the appendix were ligated with catgut and the appendix cut away, the stump being charred with the actual cautery. On account of the secretion about the appendix, it was deemed best to drain the neighborhood of the stump by means of a small piece of iodoform gauze, which was brought out through the abdominal wound at the point of intersection of the incisions through the muscular layers. The peritoneum and transversalis fascia were closed with a continuous suture of fine catgut, and each of the succeeding muscular layers with interrupted catgut sutures. Skin was closed with interrupted and continuous silk, and an aseptic dry dressing applied.

On the afternoon of the day following the operation, the patient's temperature was at 102° F., its highest point, with a pulse of 84; from this time on it gradually sank to normal, and remained so until his discharge. The patient was put on fluid diet until the third day following operation, when his bowels were opened with repeated small doses of calomel, followed by Rochelle salts and enemata, when he was allowed a light diet, gradually progressing to the regular hospital diet. The gauze drain was removed on the third day, and the skin stitches on the sixth day.

On the sixteenth day the wound had healed completely, excepting for a small sinus admitting the tip of a probe. On May 25 the wound had entirely healed with a solid union, and patient was discharged as cured.

The pathologist reports the appendix to be blood-stained on the outside, with mucous membrane a little rough; the microscopic examination showing scattered areas of moderate inflammatory infiltration of small cells.

CASE II. E. B., aged twenty-eight; married; tinsmith; Germany. Up to the time of his present illness the patient had been perfectly well. Four days before admission to the hospital he was

seized with sharp pain in the right iliac region, which became tender and sore. His bowels had moved regularly once a day. There had been no vomiting. He had had one chill, but was unconscious of any fever. The patient recalls several attacks of colic, but none similar to the present pain.

On admission to the hospital, on May 12, 1897, his temperature was 102° F.; pulse, 96; and respiration, 18. Urine was normal. He was well nourished; not anæmic; tongue slightly coated; heart and lungs normal. His abdomen presented an area of slight tenderness in the right lower quadrant, with maximum tenderness at McBurney's point. Close to the crest of the ilium there could be felt a small sausage-shaped mass, two and one-half inches long, and one-half inch in width. There was no general abdominal distention or tenderness.

He desired an operation for the removal of his appendix. Accordingly, on the afternoon of the day of his admission he was given ether, and the abdomen opened by the intermuscular procedure. The appendix was readily found and easily drawn into the wound. It was much congested, was erectile, and felt hard. There were no strictures. The meso-appendix and the base of the appendix were ligated with catgut, and the appendix cut away and removed, the stump being carefully cauterized. Abdominal wall closed in the usual manner.

The pathologist reported the specimen to present evidence of inflammatory changes in all of its coats, and the presence of a pure growth of the bacillus coli communis.

The patient made a rapid and satisfactory recovery. The temperature was 101° F. for a few days following the operation, and then fell to normal; the pulse was never above 80.

The wound healed by primary intention throughout, and on May 30 the patient was discharged with a strong abdominal wall and perfectly well.

CASE 12. M. S., aged thirty; widow; nurse; Germany. Patient had a previous history of two attacks of appendicitis, the first one year before admission, lasting for three weeks; the second nine months later and lasting one week. The illness for which she was admitted to the hospital on March 18, 1897, began two weeks before that date, with pain of a colicky character situated in the upper part

of the abdomen. In twenty-four hours this pain became localized in the right iliac fossa. There was continued tenderness at McBurney's point, and for the first three days of the attack she vomited everything ingested; but this ceased and did not return. Her bowels were constipated and she had several chills accompanied by some fever. Pain, at first severe, gradually diminished, and was hardly noticeable at time of admission. She came to the hospital with the purpose of having her appendix removed between the attacks.

On admission her temperature was 100.2° F.; pulse, 100. Urine was normal. She was a well-nourished woman; not anæmic; tongue clean; heart and lungs normal. The abdomen was normal excepting for very slight tenderness in the right iliac fossa, with maximum intensity at McBurney's point. There was slight localized muscular rigidity in the same region, but no mass could be felt.

For a week ice was applied to the appendix region, and at that time, all symptoms having disappeared, it was deemed best to operate.

On March 24 the appendix was removed by the intermuscular opening. New adhesions were numerous, and the appendix was bound down at the apex, but was easily raised. It was amputated, and the abdominal wall closed tightly in the usual manner.

Recovery was straightforward, the temperature only once reaching 100° F., and the pulse never over 100. On the fifth day the bowels were moved and the superficial skin sutures taken out. She sat up on the twelfth day, and walked two days later. On April 10 she was discharged with a firm abdominal wall.

The pathologist, Dr. Thacher, reported the appendix to be inflamed in all its coats, and cultures on blood-serum showed nearly pure culture of bacilli resembling *bacilli coli communis*.

CASE 13. K. S., female; aged twenty-three; single; house-work; Germany. Patient had never been ill up to the time of admission, and had never suffered from symptoms similar to those of the present attack. Her menstrual history had been good.

On the day preceding her admission to the hospital (January 5, 1897) she was seized with sharp pains localized in the right iliac region, and these were accompanied with vomiting. Her bowels moved regularly until the day of admission, when there was some diarrhœa. She became tender in the appendix region, the pain and

tenderness progressively increasing, and she thought she had been somewhat feverish. She was brought to the hospital in the ambulance.

On admission the physical examination revealed the following data: Patient was well nourished; not anæmic; tongue heavily coated; lungs and heart normal; abdomen slightly distended and tender all over, tenderness having maximum intensity at McBurney's point; moderate muscular rigidity in iliac fossa on right side. Temperature, 99° F.; pulse, 68; respiration, 30.

She was placed on fluid diet, bowels moved with small doses of calomel and salts, and an ice-bag applied to the appendix region. Pursuing this treatment the tenderness was much less marked at the end of two days, the general tenderness entirely disappeared at the end of three days, and the local tenderness diminished but still continued marked and circumscribed, always referred to same point. By vagina there was some tenderness and resistance in the right fornix. Temperature and pulse normal.

The diagnosis of appendicitis seemed evident, and on January 13, the patient was etherized and the abdomen opened by the intermuscular incision. The caput coli presented in the wound, and the appendix was readily found. It appeared normal, with the exception that it was somewhat swollen and very tense to the touch. There were no adhesions. The appendix was removed and the abdominal wound closed in the usual manner.

Convalescence was uninterrupted, patient sitting up on the fourteenth day, and was discharged from the hospital on February 4, 1897.

The pathologist's report on the appendix was as follows: "A soft fecal concretion at the distal end with what seems to be a slight constriction above it. Microscopic examination: No proof of inflammation in the sections examined. Mucous membrane perfect."

CASE 14. P. P., aged thirty-three; married; housewife; United States; admitted to hospital, October 29, 1896. Patient has menstruated regularly since fourteen years of age. She has had no children and no miscarriages. For the past four years, up to which time she had been perfectly well, she has had some menorrhagia, and a vaginal discharge which appears usually about two days before her menstruation. During the same period, and not in any way as-

sociated with her menstrual periods, she has had attacks of pain in the right iliac region and in the back. These attacks have followed each other at periods varying from two to four weeks, and each attack lasted about two days. In each attack the abdomen becomes tense, distended, and tender; there has been no nausea, vomiting, or irregularity of the bowels, and no symptoms referable to kidneys or liver. She has not lost flesh, but of late the severity of the pain has entirely incapacitated her for work, and most of her time is spent in bed. Her last attack was ten days ago.

On admission the abdomen was found soft and non-resistant. There is a point of circumscribed tenderness two inches inside of the anterior superior spine of the right side. No mass made out. Right kidney palpable and movable. By vagina slight tenderness in right fornix. Physical examination otherwise negative. Temperature, 98° F.; pulse, 92.

Her bowels were opened with compound licorice powder and enemata.

On October 30 ether was administered, and the abdomen opened in the usual manner by the intermuscular incisions. The corner of the omentum was found adherent to the cæcum near the base of the appendix. There were no adhesions about the appendix, which, however, appeared thickened and congested. Appendix was removed in the usual manner, the base and mesentery being ligated with catgut. No pus was found. The right kidney was readily palpated through the wound, and was found freely movable, so that the examining hand could practically pass over its posterior surface. No other abnormality was found. The abdominal wound was closed as in Case 2.

Convalescence was uninterrupted and uneventful. On the day following operation pulse was 120, and highest temperature 100.5° F., and from this fell to normal on the sixth day. Kept on fluids until the sixth day, when her diet was gradually increased. On the third day her bowels were moved with small doses of calomel, salts, and enemata. Skin sutures removed on seventh day.

Allowed out of bed on the fourteenth day, and discharged on November 17, the twentieth day after operation, with a strong abdominal wall showing no impulse at side of wound on coughing.

Pathologist reports distention of appendix with fecal matter but no inflammation.

CASE 15. C. C., aged twenty-seven; married; housewife; United States; admitted to hospital, November 6, 1896. Her previous history was uneventful up to five years ago, at which time, following the birth of her only child, she had an attack of puerperal sepsis. Since that time, at intervals of six to eight months, she has suffered from attacks characterized by pain in the back and abdomen, not accompanied by chills, nausea, or vomiting, each lasting about five days. The attacks have not been associated in any way with her menstrual periods, which have been regular and without pain. Her present illness she believes to be unlike any of her preceding attacks. This began six days before admission, with pain in the right side of the abdomen, and vomiting at intervals of about three hours, or whenever anything was taken into the stomach. Her bowels have moved every day, but she has been feverish all the time, and had a distinct chill on the fourth day of her attack.

On admission the only abnormalities discovered by physical examination were an area three inches in diameter, with its centre at McBurney's point, which was the site of marked pain and tenderness, and two small bed-sores of the right buttock. Temperature, 101° F.; pulse, 106; respiration, 26.

The diagnosis of recurrent appendicitis was made and the patient was at once etherized and the abdomen opened, as in Case 2, by the intermuscular method. The appendix, curled up at its end, was found directed downward from the cæcum and very firmly bound down in the iliac fossa by thick adhesions. These were broken down as gently as possible, the appendix removed, and the abdominal wall closed as in Case 2.

Following the operation the patient's temperature fell to normal and her pulse to 94. She was slightly restless, and suffered some little sharp pain in the region of the wound, but not enough to demand an opiate. On the following day her bowels were moved, as in Case 2, being allowed a fluid diet, the quantity of milk being, however, restricted.

Her convalescence was uneventful, her temperature never being above 99.8° F., and pulse averaging 85. The superficial drains were removed on the third day and the silk sutures on the sixth. She sat up out of bed on the fifteenth day, and was discharged, with no evidence of a weak abdominal wall, on the twenty-second day.

Dr. Thacher, the pathologist, reported a microscopical examination of the appendix showing "marked inflammation in all coats."

CASE 16. M. W., male; aged eighteen; single; clerk; United States; admitted to the hospital, November 11, 1896. He had been watched for some time by his own physician, who was a careful observer, and sent him to the hospital with the diagnosis of recurrent appendicitis, and with the following history: Patient had been well and strong up to three years ago, when he began to have attacks of pain in the right iliac region, accompanied with nausea, bilious vomiting, and constipation. These attacks at first lasted about four days, and were separated by intervals of six months. His last attack was the third in the past two months. This began ten days ago and has now practically subsided. It was characterized by sharp pain localized in the right iliac region, constipation, and vomiting, a point of local tenderness with greatest intensity at McBurney's point, and a slight swelling and rigidity of the abdominal wall in this region. On the first day of the attack the pain was sudden and sharp, his temperature ranging from 101° to 103° F. His treatment consisted in the application of ice locally, and the administration of salines and morphine. His symptoms practically subsided in three days, and on admission to the hospital he felt in usual good health.

On admission the patient appeared well nourished; not anæmic; tongue clean; heart and lungs normal; liver and spleen normal. Abdomen soft; no masses felt; very slight tenderness at McBurney's point on deepest palpation. Urine normal.

His temperature and pulse remained normal during the days he remained in the hospital, and was under observation until November 18, when he was etherized and the appendix removed by the intermuscular operation. The appendix was found turned upward back of the cæcum and lying between the folds of the meso-cæcum and bound down by adhesions. These were broken down and the appendix removed in the usual manner. No pus was discovered. The abdominal wall was closed, as in Case 2, but no drain was used, either superficial or deep.

Recovery was uneventful. There was a post-operative temperature of 101° F., which dropped to normal on the third day, with no subsequent rise. The pulse was never above 100, and he had abso-

lutely no pain. His bowels were moved on the third day; the superficial sutures were removed at the end of a week, and he was allowed out of bed on the eighteenth day, and discharged from the hospital, with a firm abdominal wall, four days later.

Microscopic examination of the appendix by Dr. Thacher showed "slight signs of inflammation."

CASE 17. C. N., aged twenty-four; single; butler; United States. Patient gave the history of having had three attacks of appendicitis during the past two months, each attack lasting from two to three days. Present attack began three days prior to admission, after he had ridden forty miles on his wheel, with pain and tenderness over McBurney's point, which grew better on assuming a recumbent position. Bowels moved each day after catharsis. No chills, fever, nor vomiting. On admission temperature was 99° F.; pulse, 92. Physical examination revealed a mass, size of a lemon, situated just at McBurney's point, which was only slightly tender, not adherent but movable under the abdominal wall. There was no general distention, nor tenderness, nor muscular rigidity. It was deemed advisable to wait some time before operating to allow of the absorption of some of the inflammatory products, so patient was put on fluid diet and given an ice-cap over the appendix region. Pain entirely disappeared from the appendix in two days and patient remained very comfortable for eleven days, when his old pain came back and his temperature went up to 101° F., his pulse remaining about the same. During this time there had not been much change in the mass save a slight diminution in size. Operation was now deemed advisable, so on November 3 ether was administered, and an intermuscular operation performed, the skin incision being over the outer portion of the mass. By retracting the muscles well with four retractors, a considerable opening was made into the peritoneal cavity. A piece of omentum, which covered the mass beneath, was adherent to the anterior abdominal wall. This was removed, being freed from its attachments, a stout catgut ligature having been placed about it. A vessel in the stump was secured by an additional ligature. The mass was then more clearly palpated. After breaking up some adhesions around the cæcum, the appendix was found, much inflamed and swollen but not gangrenous, situated behind and to the inner side of the cæcum, with its tip pointing downward.

The appendix was entirely freed from all its adhesions, no pus at any time being encountered, and brought out into the wound. The appendix was about four inches long, and its large mesentery was secured by a catgut ligature. Another ligature of catgut was placed about the base of the appendix, which was then removed and its stump well cauterized. No difficulty was experienced in this intermuscular operation in getting the appendix out, because of the smallness of the opening, which needed no enlarging. A small strip of iodoform gauze was inserted down to stump of appendix and rest of incision closed by catgut, layer by layer, in the usual manner. Convalescence uneventful. Was dressed on the fifth day, and there was a slight sero-purulent discharge; small piece of packing reinserted, which was discontinued on the tenth day, and the edges of the wound allowed to fall together. On the twentieth day wound entirely healed.

CASE 18. J. L., aged twenty; female; maid; Scotland. Patient had always enjoyed good health until six weeks ago, when she had an attack of pain localized in the right iliac fossa accompanied by vomiting; this passed away in a few days and she was well until five days before admission, when she began again to have pain on the right side of the abdomen and marked tenderness, which gradually increased and became general, involving the whole abdomen; she had some fever but no vomiting or chills; her bowels moved regularly.

On admission to the hospital, on November 27, 1897, her tongue was heavily coated. Her abdomen was tender in the region of McBurney's point, and there was a sensation in this region as if the intestines had been matted together; here, also, there was muscular rigidity. As a whole the abdomen was soft and pliable and the normal tympany was not increased. A diagnosis of recurrent appendicitis was made.

She was placed on a fluid diet, and ice was applied to the appendix region, in the hope that the inflammatory process might subside; her bowels were moved with small doses of calomel.

One week after admission the tenderness and pain had entirely disappeared, and the patient was allowed out of bed.

On December 8, the patient at this time having no symptoms of appendicitis, desired an operation for the removal of the appendix

during the period of quiescence. She was accordingly anæsthetized and the appendix removed by the intermuscular operation.

The appendix was found surrounded by adhesions, but not tightly bound down by them; it was much congested and swollen, with a narrowed portion, apparently a stricture, near its junction with the cæcum. It was removed and the abdominal wound closed in the usual manner.

Her recovery was absolutely uneventful; pulse and temperature were at no time above the normal, and she was allowed out of bed on the seventeenth day after operation. By her own request she was allowed to remain in the hospital two weeks longer, at the end of which time she was discharged with an unyielding abdominal wall and small scar.

Dr. Thacher, the pathologist, reported the microscopical examination of the appendix showed "marked inflammation, especially on the outer surface."

XVII.

THE TUBERCULIN TEST FOR THE PRESENCE OF TUBERCULOSIS.

BY W. P. NORTHRUP, M.D.

THE following tests of the value of the tuberculin for diagnostic purposes were undertaken in the medical wards of the Presbyterian Hospital in the Spring and Fall of 1897. The cases tested were all adults excepting one.

A paper by Dr. Trudeau appearing at that time (*The Medical News*, May 29, 1897) served as working guide, and certain oral communications from the same source assured the beginning of these investigations at the outset, on mature lines. First of all it was necessary to have a reliable preparation of tuberculin and a uniform, diluted, injecting solution. The tuberculin used was made according to Koch's original standard, was furnished by Dr. E. L. Trudeau, Saranac Laboratory, and kindly contributed for this work.

The diluted solution used was prepared by Dr. George A. Tuttle in the Pathological Laboratory of the Presbyterian Hospital, of a uniform strength, one milligramme to one cubic centimetre of distilled water with carbolic acid, one-half of one per cent.

This solution was made up frequently, kept in a cool place, never used after the solution was more than two weeks old, always made in the same way, injected with the same syringe by the same assistant and in the same part of the body, at the same hour of the day. In other words, a standard grade of tuberculin was used, in constant dose, and under uniform conditions.

DOSE AND ADMINISTRATION.

The initial dose was at first half a milligramme; later it was thought just as well to begin in adults with one milligramme. This was injected subcutaneously in the dorsal region, between the scapulae, at midnight. The reaction was expected to begin from eight

to twelve hours later, the temperature returning to normal from twenty-four to forty-eight hours thereafter. Injected at the above hour, the patient was under close observation during the hours of expected reaction, the temperature chart showing its characteristics at the usual time of afternoon rounds. If there was no reaction from one milligramme, two or more often three, days were allowed to elapse, and a second dose of two milligrammes was similarly administered. If this dose gave no reaction, three, then four milligrammes were administered after equal intervals.

SELECTION OF CASES.

In order to judge correctly of the degree of reaction, it was necessary that the patient should have been without fever (temperature taken every four hours) for some days, or should have a chart showing a small daily uniform variation, its average being not above 100° F. Such patients were selected from their charts, without regard to the lesions from which they were convalescing, excluding only cases of cardiac lesions sufficiently severe to cause symptoms, and over-nervous persons and convalescents from typhoid and other exhausting diseases.

Among these may be mentioned cases convalescent from acute articular rheumatism, malaria, acute bronchitis, lateral sclerosis, anæmia, post-diphtheritic paralysis, cerebro-spinal meningitis, chronic nephritis, varicose ulcer of leg, etc. These it will subsequently appear were among the class of "unsuspected cases," as regards tuberculosis.

Local Irritation.—Swelling, tenderness, and redness about point of injection, lasting one to two days, were the features noted; no suppuration. Local irritations were only occasional.

Pain in joints, suspected to be tuberculous, was frequent but not constant. Pain in chests of patients reacting led to the suspicion of localized tuberculosis, but physical signs did not usually make it certain.

It was thought that the carbolic acid used to preserve the solution might be the cause of the local irritation at sight of injection when large doses were given. In several cases, to test this, the solution was made up fresh and used at once, without any carbolic. Reaction followed in the same patient to the same degree when no carbolic-acid preservative was used. Also a control test was made by inject-

ing an equal volume of distilled water, holding in solution an equal amount of carbolic acid—no local irritation.

The points of greatest interest are :

1. Is there any harm to the patient in the test?
2. Is it of practical value?

The answer to the first inquiry is: In sixty-one cases tested with doses varying from one-half to eight milligrammes there was no evidence of any harm, nor is it the opinion of the writer or of any observer that there was the slightest evidence of injury to any individual. Indeed, the patients, after recovering from the reactions, usually believed they were improved by its administration, and believed themselves objects of especial care, profiting by new and improved methods of advanced medicine. Repeatedly the staff and myself, in our rounds, had occasion to say that if we could come to these patients with the mental preoccupation that Koch's was a sovereign tonic remedy, we would feel assured of this correct judgment from what we saw, and what these patients told us. They avowed themselves much improved, were willing to remain in hospital four days longer for the purpose of receiving another injection, however pronounced the reaction may have been, and however much they wished to go home.

General Reaction.—A characteristic reaction, constitutionally, manifested itself usually by rise of temperature above its habitual line, either the normal or the line of daily variations, the rise taking place six to twelve hours after the injection of tuberculin, the temperature continuing twenty-four hours or more above normal. In other words, the temperature curve on the chart is characterized by a rather sudden rise, a continuance for a variable time at a high level, and a rapid decline. The patient has a flushed face, headache, sometimes local pains in joints or chest, sometimes nausea, seldom chilliness, seldom vomiting, usually malaise.

These symptoms appear with the fever, continue and depart with it, the patient feeling quite as well as usual thereafter, and one could be easily convinced, feeling better.

The cases to be considered are sixty-one in number. To answer the two questions proposed, a large number of cases must be injected, those believed to be free of tuberculosis, and having different ailments, as well as those suspected, and those known to have tuberculosis. No definite conclusions can be drawn from so limited

a number as here given, but if they bear internal evidence of having been carefully observed and faithfully recorded they will be accepted as a contribution to the discussion of tuberculin as an aid to diagnosis.

NOTE.—In the following cases no tubercle bacilli (T. B.) were found and no local reaction occurred, unless mentioned.

I.—Cases (sixteen in number) reacting, in which clinically a diagnosis of tuberculosis could be made from

(a) Presence of T. B. in sputum. (b) Physical (chest) signs. (c) Previous history, bone lesions, and general condition.

Case 1.—Male, aged twenty-four. Tuberculosis of hip-joint. Opinion confirmed by Dr. N. M. Shaffer. Treated several months by extension. Reacted to tuberculin, 3 milligr.; no reaction to less amounts. No evidence of tuberculosis elsewhere. Usual temperature ranged from 98.8°–99.8° F. Temperature 6 to 12 hours after injection, 99°–101.8° F.; from 12 to 24 hours after, 101.8°–98.2° F. Thereafter temperature pursued its usual course.

Case 2.—Female, aged twenty-seven. T. B. in sputum. Reaction from $\frac{1}{2}$ milligr.: Temperature before injection, 98.8°–99.8° F.; after 6 to 12 hours, 100°–101.4° F.; after 12 hours, 101.4°–100.4° F.; after 24 hours, 100.4° F. Malaise.

Case 3.—Male, aged thirty-six. T. B. in sputum. Reaction from $\frac{1}{2}$ milligr.: Temperature before injection, 98.4°–99.3° F.; after 6 to 12 hours, 101.3°–103 F.; after 12 to 24 hours, 103°–103.4° F.; after 24 to 48 hours, 100°–99° F. Pain in left chest.

Case 4.—Male, aged nineteen. T. B. in sputum. Reaction from $\frac{1}{2}$ milligr.: Temperature before injection, 98.4°–99.3° F.; after 6 to 12 hours, 99°–101.4° F.; after 12 to 24 hours, 101.4°–98.2° F.; after 24 to 48 hours, 98.2°–99.6° F. Malaise.

Case 5.—Female, aged twenty-six. T. B. in sputum. Reaction from 2 milligr.: Temperature before, 99°–100.4° F.; after 6 to 12 hours, 100.4°–101.2° F.; after 12 hours, 101.2°–102.6° F.; after 24 hours, 102.6°–99° F. Malaise.

Case 6.—Male, aged sixty. Arthritis; pronounced by Dr. Shaffer tuberculous. Slight reaction from 1 milligr.; marked after 2 milligr.: Temperature before, 99°–100° F.; after 6 to 12 hours, 99°–102.4° F.; after 12 to 24 hours, 102.4°–102.8° F.; after 24 to 48 hours, 102.8°–99° F. Headache, pain in ankle, malaise. Subsequently 2 milligr. were given again without reaction. The question arose as to the establishing of tolerance by repeated doses. A year previously this man had a similar attack in the same ankle, lasting two months. Thickening about bones of left ankle. Chest asymmetrical (retracted?), poorly developed, emaciated. No physical signs of pulmonary disease at present, no sputum.

Case 7.—Female, aged twenty-four. Dulness, exaggerated breathing, and râles, front, right upper; night-sweats, loss of flesh, white "swelling" of knee. Reaction from 3 milligr.: Temperature before, 99.6°–98.4° F.; after 6 to 12

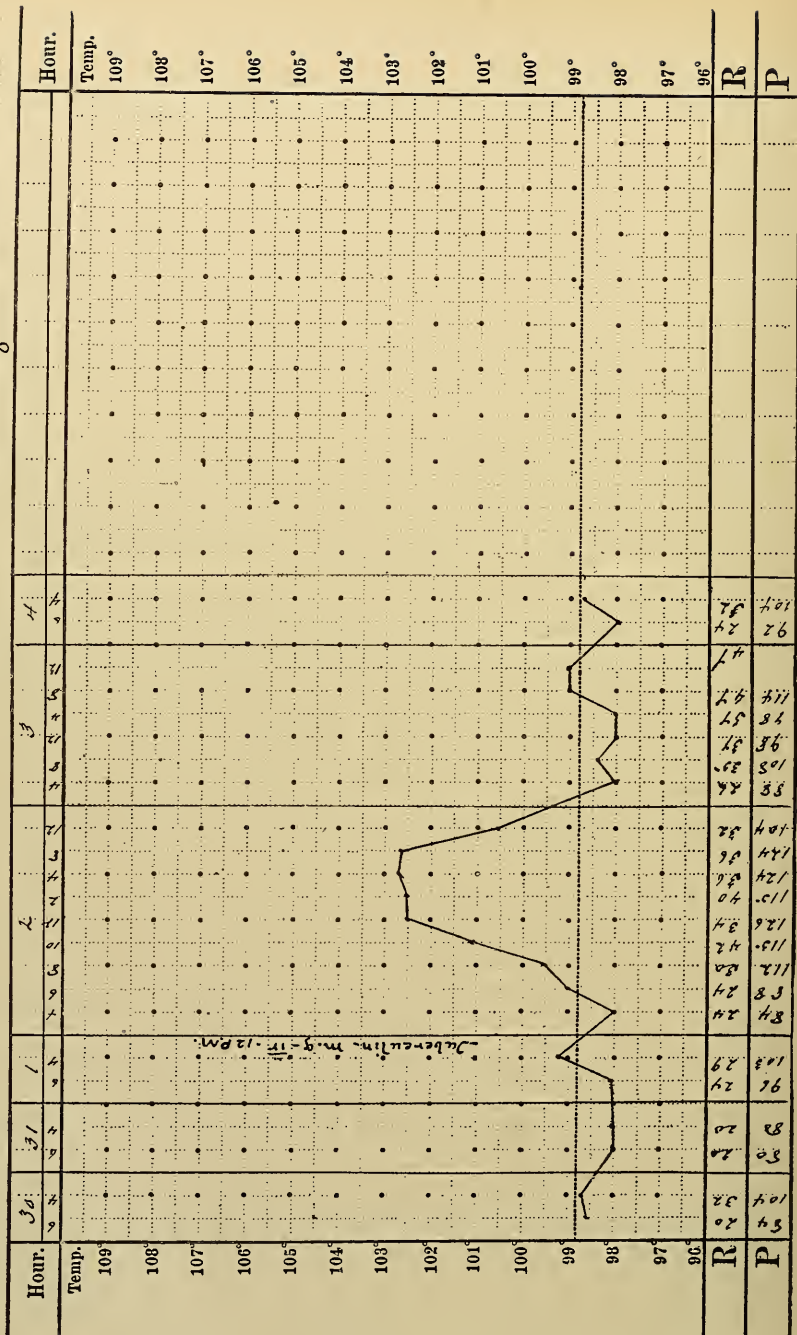


CASE 47.

Name Hollis S.

529

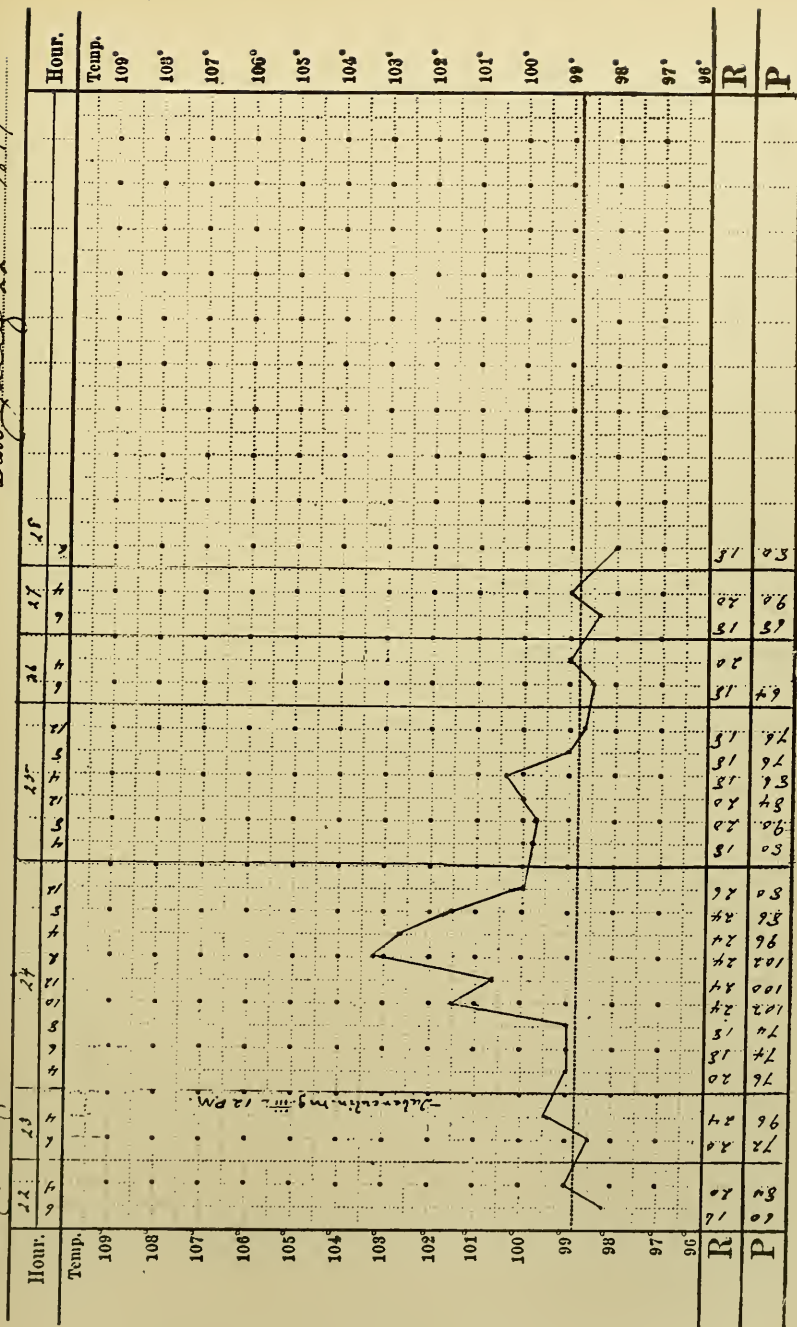
Date August 30th 1897



CASE 58.

Name Joseph L. C. C.

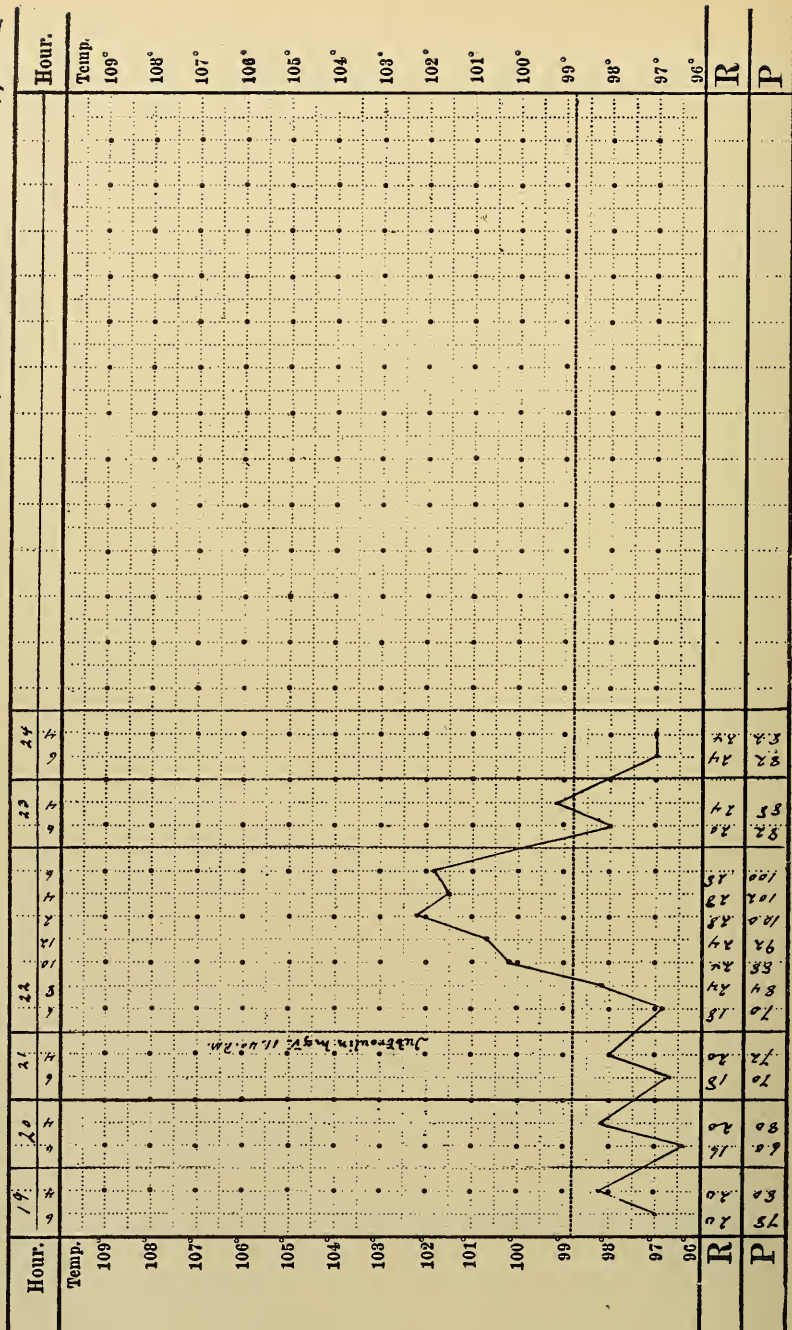
Date July 22nd 1897



CASE II.

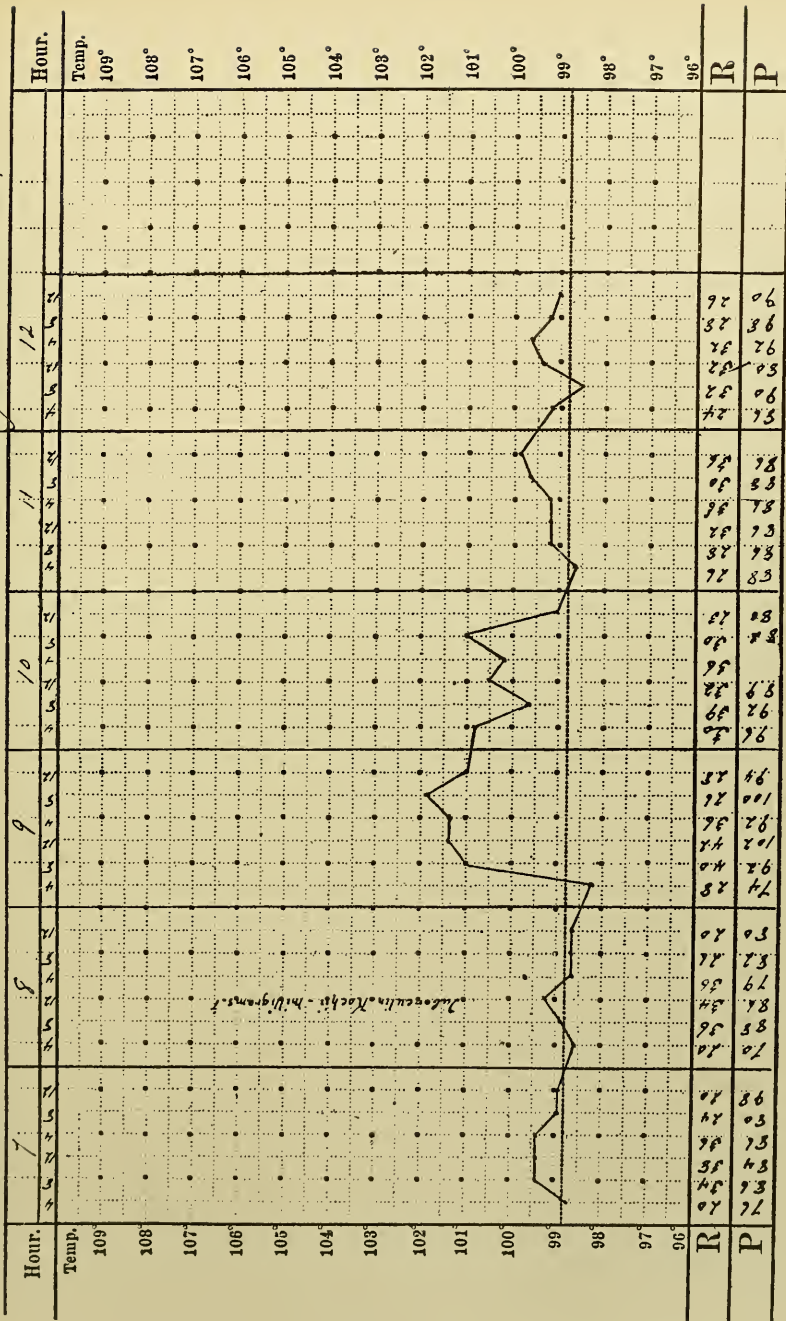
Name William B.

Date November 19th 1897



Name John C. H.

Date June 3rd 1897



hours, 98.4° – 102° F.; after 12 hours, 102° – 102.4° F.; after 24 hours, 102° – 100° F. Nausea, headache, muscular pains. Four milligr., reacted in 16 hours, 103.6° F., with malaise returning to normal in 24 hours.

Case 8.—Male, aged eighteen. T. B. in sputum, pulmonary and laryngeal. Reaction from 5 milligr.: Temperature before, 100° – 98° F.; after 6 to 12 hours, 98° – 101.4° F.; after 12 to 24 hours, 101° – 99° F.; after 24 hours, 99° F. Chilly, headache, malaise. After 1 milligr., chilliness, local reaction, pain in throat.

Case 9.—Male, aged twenty. Cavity, right apex, sweating, anæmia. Reaction from 1 milligr.: Temperature before, 100° – 99° F.; after 6 to 12 hours, 99° – 102.2° F.; after 12 hours, 102° – 99.4° F.; after 24 hours, 99° – 101.4° F. This reaction not being fully satisfactory, 3 milligr. were given nine days later. Temperature before, 101° – 99° F.; after 6 to 12 hours, 99° – 103.5° F.; after 12 hours, 103.5° – 99.2° F.; after 24 hours, 99.2° – 102° F. Temperature as observed on the chart convincing that it was a reaction.

Case 10.—Male, aged thirty-six. T. B. in sputum. Cavity. Reaction from 1 milligr., short duration, 101.3° F. at the end of 16 hours. A week later, reaction, from 2 milligr.: Temperature before, 98° – 98.6° F.; after 6 to 12 hours, 98.6° – 103.2° F.; after 12 hours, 103.2° – 101° F.; after 24 hours, 101° – 99.6° F. Vomiting, headache, malaise.

Case 11.—Female, aged twenty-three. T. B. in sputum; cavities both apices. Reaction from 5 milligr.: Temperature before, 96.6° – 98° F.; after 6 to 12 hours, 98° – 102.2° F.; 12 to 24 hours, 102.2° – 100° F.; after 24 hours, 100° – 98° F. Malaise. No reaction after 1 milligr.; slight after 3 milligr., with apparent increase of cough. Temperature reached 99.5° F. after 12 to 24 hours.

Case 12.—Male, aged twenty-seven. Cough, râles, emaciation, hemoptysis, pneumothorax. Reaction from 4 milligr.: Temperature before, 97.5° – 98.6° F.; after 6 to 12 hours, 98.6° – 100° F.; after 12 hours, 100° – 101.6° F.; after 24 hours, 101.6° – 100° F. Headache and local reaction. Five days later was given 5 milligr., without reaction.

Case 13.—Female, aged twenty-eight. Crepitant râles at apex and slight dulness; entered with peripheral neuritis. Not tuberculous in general appearance; no cough. Slight reaction from 1 milligr.: Temperature before, 98.5° – 99° F.; after 6 to 12 hours, 99° – 100.4° F.; after 12 hours, 100.4° – 99° F.; after 24 hours, 99° – 99.2° F. Slight reaction from 3 milligr.; highest, 100.2° F., returning to 99° F. in 48 hours.

Case 14.—Male, aged forty. Pleurisy with effusion two years before. Emaciated, looks tuberculous, dulness, exaggerated voice and breathing in apex, râles, irregular temperature, no expectoration. Reaction from 2 milligr.: Temperature usually 100° – 101.5° F.; before injection, 99.8° – 100.4° F.; after 6 to 12 hours, 100.4° – 104.4° F.; after 12 hours, 104.4° – 103° F.; after 24 hours, 103° – 99.8° F. Pronounced malaise.

First dose administered was $\frac{1}{2}$ milligr., no reaction; second dose, 2 milligr., reaction as above; third dose, 1 milligr. Temperature reached 103.4° F. Typical in all respects. Tolerance not established.

Case 15.—Male, aged thirty-six. Small cavity in right apex, and consolidation. T. B. found after long searching. Reaction from $\frac{1}{2}$ milligr.: Tempera-

ture before, 98.4° – 99.3° F.; after 6 to 12 hours, 101.3° – 103° F.; after 12 hours, 103° – 103.4° F.; after 24 hours, 100° – 99° F. Pain in chest, malaise.

Case 16.—Male, aged twenty-four. Hæmoptysis, loss of flesh, night-sweats, cough, expectoration, irregular temperature, crepitant and subcrepitant râles over left lung, with dulness at apex. No T. B. after repeated examinations. Slight reaction from $\frac{1}{2}$ milligr., 101° F. in 24 hours. Reaction from 1 milligr. Temperature, 101.4° F.; [see graphic chart, case 16] 12 to 24 hours after injection, chilly, slight local swelling and tenderness. Reaction from 2 milligr. characteristic and well marked: Temperature before, 99.7° – 98.7° F.; after 6 to 12 hours, 98.7° – 103.5° F.; after 12 hours, 105° – 103.5° F.; after 24 hours, 103.3° – 100° F. Headache, chilly, nausea, general malaise, pain in left chest. Temperature returned to normal, and patient left hospital improved, having gained eight pounds. Sputum injected into guinea-pig.

II.—Cases (nineteen in number) *not* reacting, in which there was no reason to suspect tuberculosis.

Case 17.—Female, aged thirty-two. Cerebral tumor. On fifth injection of 4 milligr., temperature after 16 hours, 101.4° F. No general symptoms. On sixth injection of 5 milligr., temperature after 14 hours, 101.2° F. No general symptoms. Temperature normal after 24 hours. Patient left hospital. Diagnosis: Brain tumor. From the course of temperature observed on the chart this was not regarded as a reaction.

Case 18.—Male, aged thirty-eight. Lobar pneumonia. Previous to entrance cough for three months, and loss of flesh. Wife had phthisis. A child died of "meningitis." No T. B. found. No reaction from 5 milligr. Recovery complete. Appearance such as not to create a suspicion that he was tuberculous.

Case 19.—Male, aged fifty-four. Syphilitic pachymeningitis. No reaction from 2 milligr.

Case 20.—Female, aged twenty-six. Gastro-enteritis, anæmia. Brother died of phthisis. Fairly strong and healthy appearing. No reaction from 1, 2, or 3 milligr.

Case 21.—Male, aged thirty-nine. Sciatica. Large, healthy-looking man. No reaction from $\frac{1}{2}$ to 1 milligr. Slight local reaction.

Case 22.—Female, aged forty-five. Gastritis. No suspicion of tuberculosis. No reaction from 1, 2, 3, 4, or 5 milligr., either constitutional or local.

Case 23.—Male, aged sixty-five. Cerebral hemorrhage, hemiplegia. Large, robust man, engineer. No reaction from $\frac{1}{2}$, 1, 2, or 3 milligr., at intervals of three days, till 8 milligr. were given. No reaction, local or constitutional.

Case 24.—Female, aged one and one-half. Chronic spinal meningitis; recovered. Lumbar puncture; fluid negative on guinea-pig inoculation. No reaction from $\frac{1}{4}$ milligr., grading up to 1 milligr.

Case 25.—Male, aged forty-one. Multiple neuritis. No reaction from $\frac{1}{2}$ to 1, 2, 3, or 4 milligr.

Case 26.—Male, aged thirty-five. Diagnosis on entrance: Constipation.

Well nourished; negative history. No reaction from 1 milligr. No further given.

Case 27.—Female, aged thirty-five. Puerperal sepsis. Negative history. No reaction from $\frac{1}{2}$ milligr. Left hospital.

Case 28.—Male, aged forty-nine. Dyspepsia. No evidence of tuberculosis. No reaction from 1, 4, or 6 milligr. None, local or constitutional.

Case 29.—Female, aged thirty-three. Malaria (plasmodium found). No reaction from 1 or 2 milligr. Malarial chill set in 48 hours after last injection.

Case 30.—Male, aged fifty. Cirrhosis of liver; pleurisy, sero-fibrinous. No T. B. found in sputum or fluid. No reaction, local or constitutional, from 1, 3, 5, or 7 milligr.

Case 31.—Female, aged fifty-five. Malignant tumor of the kidney (sarcoma), confirmed by exploration. No reaction from 1 or 3 milligr.

Case 32.—Female, aged fifty-one. Gastric ulcer, abscess of pancreas (autopsy). Slight rise of temperature after 3 milligr. No malaise, uncertain reaction.

Case 33.—Female, aged thirty-six. Right kidney enlarged; leucocytes in urine, moderate amount. No T. B. found. Well-nourished, no loss of flesh. No reaction from 1, 2, or 3 milligr.

Case 34.—Female, aged fifty-six. Tertiary syphilis. Poorly nourished, slight cough, slight dulness, breathing harsh; few râles, not constant, in upper right lobe. Continuous temperature for eleven weeks. History negative; no sputum. One, 2, 3, and 5 milligr. given. No malaise; slight elevation of temperature, not considered a reaction.

Case 35.—Male, aged forty-two, maltster. Cirrhosis of liver. No reaction from $\frac{1}{2}$ or 1 milligr. Died. No autopsy.

III.—Cases (sixteen in number) reacting, in which tuberculosis was clinically suspected.

Case 36.—Female, aged twenty-four. Diagnosis: Tuberculosis of ovaries or peritoneum; general abdominal pains and tenderness for five months; loss of flesh. Reaction from 1 milligr.: Temperature before, 98.2°–99.6° F.; after 6 to 12 hours, 99.6°–99.4° F.; after 12 hours, 99.4°–102.6° F.; after 24 hours, 102.6°–100° F. Headache, malaise, increased abdominal pain. Nine days later, 1 milligr. again given. After 12 to 24 hours, 101°–100.5° F., with malaise. Six days later, 2 milligr.: Temperature, 12 to 24 hours after, 102.8°–101.6° F. One week later, 2½ milligr.: Temperature before, 98°–98.2° F.; after 6 to 12 hours, 98.2°–102.8° F.; after 12 hours, 102.8°–101.5° F.; after 24 hours, 101.5°–98.8° F. Malaise, moderate local reaction.

Case 37.—Male, aged forty-five. Diagnosis: Tuberculous ankle. Father and sister died of phthisis. Ankle swollen, muscles of leg atrophied. Reaction from 5 milligr. twice: Temperature before, 99.2°–97.8° F.; after 6 to 12 hours, 97.8°–100.5° F.; after 12 hours, 100.5°–101.8° F.; after 24 hours, 101.8°–99° F. Pain in foot, general malaise.

Case 38.—Male, aged eighteen. Tuberculous arthritis of knees and elbow

opinion of Dr. N. M. Shaffer. Negative family history. Duration, five years. Slow reaction from 2 milligr. : Temperature before, 98.4° – 100.5° F. ; after 6 to 12 hours, 100.5° – 100.2° F. ; after 12 hours, 100° – 101.6° F. ; after 24 hours, 101.6° – 100.2° F. At a subsequent injection of 2 milligr., temperature rose to 100.6° F. in 14 hours, and in 70 hours to 102° F. ; then fell to normal, and so remained.

Case 39.—Female, aged fifty. Abdominal nodular masses. Bloody fluid aspirated from peritoneum and right pleura. Loss of flesh, anæmia, sputum. No T. B. found. Moderate reaction from 1 milligr. Malaise, nausea. More reaction from 2 milligr. three days later. Five days later, temperature before, 98.8° – 99° F. ; after 6 to 12 hours, 99° – 101.8° F. ; after 12 hours, 101.8° – 99.2° F. ; after 24 hours, 99.2° – 99.8° F. Vomiting, malaise, abdominal pain, and pain in right side.

Case 40.—Female, aged thirty-six. Diagnosis : Lobar pneumonia and pleurisy (tuberculous ?), consolidation persisting for weeks ; râles for two and one-half months ; profuse night-sweats ; temperature varying from 103° – 98° F. Negative family history. Moderate reaction from 1 milligr. No malaise ; reaction slight and not characteristic from 2 milligr. Reaction from 3 milligr. : Temperature before, 99.8° – 98° F. ; after 6 to 12 hours, 98.8° – 99.4° F. ; after 12 hours, 99.4° – 102.4° F. ; after 24 hours, 102° – 100° F. Pain in back and general. Patient left hospital in improved general condition, slight dulness and few râles. Eighteen days later returned for examination. Slight dulness, no râles ; condition good, improved in flesh and strength, does her own washing.

Case 41.—Female, aged twenty-three. Hemiplegia (hemorrhage) and malaria (plasmodium found). Small frame ; looked tuberculous ; expectoration (no T. B. found). Reaction from 1 milligr. : Temperature before, 100° – 99° F. ; after 6 to 12 hours, 99° – 99.5° F. ; after 12 hours, 99.5° – 103.8° F. ; after 24 hours, 103.8° – 99° F. Chill 6 hours after injection ; sudden rise of temperature, sudden fall ; spleen large, plasmodium found. Five days later, 1 milligr. : Temperature before, 98° – 99.4° F. ; after 6 to 12 hours, 99° – 102.8° F. ; after 12 hours, 103.6° – 101° F. ; after 24 hours, 101° – 99° F. Malaise, local reaction. Guinea-pig did not develop tuberculosis.

Case 42.—Male, aged forty-five. Chronic lead-poisoning (painter) and chronic nephritis. Dulness, right apex anterior, subcrepitant râles. Poorly nourished. Reaction from 3 milligr. : Temperature before, 100° – 99° F. ; after 6 to 12 hours, 98.2° – 101.4° F. ; after 12 hours, 101.4° – 101.7° F. ; after 24 hours, 101.7° – 99.5° F. Headache, nausea, malaise.

Case 43.—Female, aged seventeen. Arthritis. One joint, right ankle, œdema, pain, redness. Hæmoptysis once in life. Slight dulness and exaggerated voice apex. Does not look tuberculous. Slight reaction from 2 milligr. Pain in chest. Reaction from 3 milligr. (twice) : Temperature before, 97.2° – 98° F. ; after 6 to 12 hours, 98° – 102.2° F. ; after 12 hours, 102° – 102.8° F. ; after 24 hours, 102.8° – 99.4° F. Vomiting, malaise. After five weeks, still pain and tenderness in joint.

Case 44.—Male, aged thirty-three. Alcoholic, dry pleurisy. Irregular temperature for ten weeks— 98.6° – 103° F. Loss of flesh. Reaction from 1 milligr. : Temperature before, 99° – 101° F. ; after 6 to 12 hours, 101.4° – 103.6° F. ; after 12

hours, 103.6° – 102° F.; after 24 hours, 102° – 100° F. Malaise, slight local reaction. Subsequently characteristic reaction from 2 [see graphic chart, case 44] and 3 milligr., with malaise. On a graphic chart this was believed to be a characteristic curve, a reaction.

Case 45.—Male, aged forty-two. Pleurisy with effusion, persisting six weeks, loss of flesh. Does not look tuberculous. Slight reaction from 2 milligr. Reaction from 3 milligr.: Temperature before, 99.2° – 98.5° F.; after 6 to 12 hours, 98.5° – 102.3° F.; after 12 hours, 102.3° – 102.8° F.; after 24 hours, 102.8° – 99° F. Marked local reaction.

Case 46.—Female, aged twenty-three. Convalescence from suspected irregular typhoid fever. Slight dulness on apex, few râles. Reaction slight from 3 milligr.: Temperature before, 99° – 98° F.; after 6 to 12 hours, 98° – 100° F.; after 12 hours, 100° – 101° F.; after 24 hours, 101° – 99.2° F. No malaise. Reaction considered fairly characteristic.

Case 47.—Female, aged twenty-three. Neurasthenia, with an uncertain history of pleurisy. Father died of phthisis. Temporarily, râles, anæmia, one hæmoptysis (uncertain). Reaction from 4 milligr.: Temperature before, 98° – 99.2° F.; after 6 to 12 hours, 99.2° – 102.5° F.; 12 to 24 hours, 102.5° – 99.5° F.; thereafter normal. Malaise.

Case 48.—Female, aged twenty. Anæmia; right apex, post. expiration prolonged and high-pitched. Negative family history; well developed. Slight reaction from 1 milligr. Reaction from 2 milligr.: Temperature before, 98° – 98.4° F.; after 6 to 12 hours, 98.4° – 100° F.; after 12 hours, 100° – 101° F.; after 24 hours, 101° – 99° F. Headache, nausea, and vomiting. Two milligr. again injected gave no reaction. Three milligr. gave 100.4° F. in 24 hours, with pains in back. Four milligr. gave a marked reaction— 102.5° F. in 12 hours, falling to normal in 72 hours, with pains.

Case 49.—Female, aged twenty-eight. Small, poorly developed; cough mornings with expectoration. Reaction from 3 milligr.: Temperature before, 98.5° – 99.3° F.; after 6 to 12 hours, 99.3° – 100.2° F.; after 12 hours, 100.2° – 100° F.; after 24 hours, 100° – 98° F. Malaise. On fifth injection of 4 milligr., temperature reached 103.4° F. in 17 hours. Headache and nausea.

Case 50.—Male, aged twenty-nine. Bronchitis, dulness, right apex. Six months before had a "cold," lasting one month. Said he was always healthy; light frame. Slight reaction from 3 milligr., with pain in back. Reaction from 4 milligr.: Temperature before, 99° – 98.6° F.; after 6 to 12 hours, 98.6° – 99° F.; after 12 hours, 99.4° – 102° F.; after 24 hours, 102° – 101° F. Very marked local reaction, indurated swelling and tenderness, chill. Question—whether local reaction could not account for temperature.

Case 51.—Female, aged twenty-four. Acute rheumatism. Poorly nourished, anæmia, losing flesh, cough with expectoration, "looks tuberculous." No chest signs. Reaction from 1 milligr.: Temperature before, 98.5° – 98° F.; after 6 to 12 hours, 98° – 98.6° F.; after 12 hours, 98.6° – 102° F.; after 24 hours, 102° – 99.5° F. Malaise, pains in legs.

IV.—Cases (seven in number) *reacting*, in which tuberculosis was not suspected or was clinically doubtful.

Case 52.—Male, aged thirty-two. Acute articular rheumatism. Brother died of tuberculous laryngitis. Reaction from 3 milligr.: Temperature before, 98.4°–98.6° F.; after 6 to 12 hours, 98.6°–102.8° F.; after 12 hours, 102.8°–103.6° F.; after 24 hours, 103.6°–99.5° F. Malaise. Three milligr. repeated after four days gave: Temperature before, 99.2°–99° F.; after 6 to 12 hours, 99°–104.2° F.; after 12 hours, 104.2°–104.3° F.; after 24 hours, 104.3°–98.3° F. Reactions marked and characteristic, and no foci found.

Case 53.—Male, aged twenty-one. Post-diphtheritic paralysis of legs. Healthy-looking, not strong frame. Negative family history. Slight reaction from $\frac{1}{2}$ milligr., more from 1 milligr. Reaction from 2 milligr.: Temperature before, 99.4°–99.4° F.; after 6 to 12 hours, 99.4°–101.6° F.; after 12 hours, 101.6°–102.6° F.; after 24 hours, 102°–99.8° F. Headache.

Case 54.—Male, aged two and one-half years. Cerebro-spinal meningitis. Convalescent. One-fifth, $\frac{1}{3}$, 0.6 milligr., up to 1 milligr., with no reaction; 1 $\frac{1}{3}$ milligr. gave reaction. Temperature reached 101° F. in 12 hours, 100.8° F. in 14 hours. Fair reaction. Recovered from chronic spinal meningitis, but deaf; double optic neuritis. Spinal puncture; no tuberculosis in injected guinea-pig.

Case 55.—Male, aged twenty-two. Poor development, chronic hydrarthrosis, fluid clear, no growth on blood-serum. Reaction fair (101.9° F.) from 2 milligr. Second injection of 2 milligr.: Temperature before, 98°–99.6° F.; after 6 to 12 hours, 99.6°–102° F.; after 12 hours, 102°–100° F.; after 24 hours, 100°–99.6° F. No symptoms. Patient under observation three months; condition unchanged.

Case 56.—Male, aged thirty-four. Malaria, negative personal and family history. Three milligr. gave good reaction, and no malarial organisms found: Temperature before, 98.2°–98° F.; after 6 to 12 hours, 98°–100° F.; after 12 hours, 100°–102.2° F.; after 24 hours, 102.2°–99.2° F. Subsequently did not react to 4 milligr.

Case 57.—Female, aged sixty. Varicose ulcer of leg. Subcrepitant râles in both bases on entrance. Reaction from 3 milligr. (103.4° F.), local and constitutional. Reaction from 4 milligr.: Temperature before, 97.4°–98.5° F.; after 6 to 12 hours, 98.5°–102° F.; after 12 hours, 102°–103.2° F.; after 24 hours, 103.2°–100° F. General malaise, vomiting. Subsequent injection of 3 milligr. gave 104.6° F. in 12 hours. Malaise, vomiting, and local reaction. Six injections given, reactions from 3 and 4 milligr.

Case 58.—Male, aged forty-six. Lateral sclerosis. No evidences of tuberculosis. Reaction from 3 milligr.: Temperature before, 99°–99.4° F.; after 6 to 12 hours, 99.4°–101.4° F.; 12 to 24 hours, 101.4°–103.2° F.; after 24 hours, 100.2°–99° F. Three milligr. subsequently produced no reaction. Question—whether tolerance was established.

V.—Cases (two in number) not reacting, in which tuberculosis was clinically suspected.

Case 59.—Male, aged fifty-two. Pleurisy, sero-fibrinous (pneumonia eleven years before), loss of flesh. Dulness, persisting four weeks after aspiration,

with moderate irregularity of temperature. Thirty ounces of fluid aspirated; no growth on blood-serum. No reaction after $\frac{1}{2}$ or 1 milligr.; after 2, uncertain. Patient left hospital.

Case 60.—Male, adult. Emphysema, hæmoptysis. Sister died of phthisis. Winter cough, expectoration, sweating. Two hemorrhages, bright blood, on day of admission. Râles over upper right front and back. No T. B. found. No loss of flesh. Left hospital with lungs clear of râles. No reaction from 1, 2, or 3 milligr. Dr. James felt certain this case had tuberculosis.

VI.—No reaction. A case (one) afterward proved tuberculous (autopsy).

Case 61.—Female, aged twenty-six. Brain tumor, which on autopsy proved to be spindle-cell sarcoma—pressing upon the pons sufficiently to deform and displace it. In addition to this there were found at one apex a few adhesions, a number of old caseous nodules, and a few recent tubercles in near proximity. This case was never suspected to be tuberculous; examination of lungs negative. No reaction from 1, 3, or 5 milligr. : Temperature before, 96°–100° F.; with 1 milligr. after 6 to 12 hours, 98° F.; after 12 to 24 hours, 100° F.; from 24 to 48 hours, 97° F. After 3 milligr., highest temperature was 98.4° F. After 5 milligr., 99.8° F. was the highest temperature 12 hours after injection. Question—Did pressure upon thermic centres cause the fluctuation of temperature, and interfere with the test?

TOTAL, SIXTY-ONE CASES.

Group I.—Reacting, tuberculous, 16 cases.

Group II.—*Not* reacting, *not* tuberculous, 19 cases.

Group III.—Reacting, clinically suspected, 16 cases.

Behaving as *expected*, Groups I., II., III., total, 51 cases; eighty-four per cent.

Group IV.—Reacting, clinically doubtful, 7 cases.

Group V.—Not reacting, clinically suspected, 2 cases.

Group VI.—Not reacting, proved tuberculous, 1 case.

To return to the two principal inquiries of the paper, *viz.*, in this test (1) is there any harm to the patient and (2) any help to the diagnostician? There are 61 cases from which to extract the answer.

First.—There was no possible harm observed to any patient.

Second.—Of the total 61 cases, 51, or eighty-four per cent., did what was clinically expected they should do, *i.e.*, they sustained the diagnosis.

The figures say that about 5 out of 6 tests confirmed the clinical diagnosis. Here let the answer to the second inquiry stand.

In this contribution to the discussion, we have not brought forward the experiences in animal tests for tuberculosis, nor referred to the frequency with which small, unsuspected tuberculous lesions are found at autopsies. The practical value is to be worked out on the lines employed in this investigation. We have sought, so far as a limited number of cases can serve, to put forward answers to two practical inquiries and await an accumulation of experience to furnish the answer as to the practical value of the test.

If the tests were to be made on a second 61 patients, using the same strength of tuberculin, I should avoid slowly increasing doses. Tolerance may have been established in certain cases. These points have, however, been interrogated without definite results. For instance, after slowly increasing doses, patients have reacted to 5 milligr. Again, patients have reacted to 2 milligr., and have not subsequently reacted to 4 milligr. Patients occasionally reacted to a small dose, failed on intermediate, and reacted again to larger doses. These reactions and failures have thrown doubt upon certain cases, and all doubt has been testimony against a favorable judgment on the action of tuberculin. In an effort to secure judicial fairness, the tendency has been to make the results less favorable than perhaps they should be. Again, the last case (61) proved tuberculous, the presence of "a few recent tubercles" about old cheesy masses, surrounded by firm adhesions—this can be assumed to correspond to the cases reported by veterinary commissions. Cattle having small recent tuberculous masses or glandular tuberculosis most commonly show more pronounced reactions than advanced tuberculosis. Just how active the "few recent tubercles" may have been one cannot say, but here is a case proved tuberculous (beginning?) in which the test failed. Yet it must not be forgotten that the patient's temperature was fluctuating, and the lesion, brain tumor, sufficient to seriously disturb the physical economy. The effect of this upon the test no one can say in the light of present experience.

As a result of the experience here recorded it is to be advised—

(1) To be sure of the quality and strength of the tuberculin used.

In answer to further inquiry, Dr. Trudeau says: "I do not know whether it is possible yet to produce a tuberculin of standard strength, as we have no methods of standardizing it as in the diphtheria antitoxin. So many factors influence its strength which

are apparently uncontrollable, a few of which are, the virulence of the culture, its age, the exact reaction of the medium, and the details of the technique of its manufacture. After an experience of many years we find it difficult here to make tuberculin always of absolutely the same strength. Of course the strength of the tuberculin must influence the dosage with which reaction is obtained, but I hope further studies on this subject will throw more light on it."

(2) To begin, in adults, with 1 milligr. ; if there is no reaction after an interval of two or, better, three days, give 3 or 4 milligr.

SUMMARY.

The present list comprises sixty-one cases.

Sixteen cases believed to be tuberculous, all reacted to the test.

Nineteen cases believed to be *not* tuberculous, all failed to react.

Sixteen cases clinically believed to be, but never proved, tuberculous, all reacted.

Fifty-one cases, eighty-four per cent. (the above), behaved as clinically was to be expected.

Seven cases, clinically doubtful, reacted.

Two cases, clinically suspected, failed to react.

One case, subsequently proved tuberculous (autopsy "a few recent tubercles"), failed to react.

No harm to any patient from the test.

Local irritations (never suppuration) occurred occasionally in the tuberculous and non-tuberculous at sight of injection—no significance.

Constitutional reaction has a fairly characteristic temperature curve, with headache, local pains, malaise.

It is the personal conviction of the writer that with further study of dosage and methods of administration, the value of the tuberculin test will prove to be a material aid in diagnosis of latent tuberculosis.

To Dr. H. S. Carter, house-physician, I wish to express my appreciation of his never-ending devotion to the details in connection with this investigation, of his good observation and his good judgment.

XVIII.

THE DIPHTHERITIC COLITIS OF CORROSIVE SUBLIMATE POISONING.

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THE bichloride of mercury is described in text-books as a powerful irritant poison, its ingestion causing extensive changes throughout the alimentary tract by reason of its local corrosive action. The fact has long been recognized that external applications of this agent could cause toxic symptoms, but it is only of late years, since its universal employment in antiseptic dressings and irrigations, that special attention has been called to this action. Wood, in the ninth edition of his work on therapeutics, says: "Severe purging, and even fatal poisoning may result from a single external application of this preparation of mercury, and in animals killed by hypodermic injections of it, diarrhœa and other indications of gastro-intestinal irritation are prominent symptoms, facts which indicate that the bichloride is eliminated unchanged from the alimentary canal."

In the "Reference Handbook of the Medical Sciences," in the article on "Mercury," it is stated that as a result of poisoning "the mucous membrane of the stomach is reddened and injected, and there may be ulceration or gangrene. Similar appearances are found in the intestine, especially at the cæcum and sigmoid flexure. The appearances in the stomach, intestines, and kidneys are the same whether the poison has been taken externally or internally."

Blyth¹ said in 1885: "It is a curious fact that the external application of corrosive sublimate causes inflammatory changes in the alimentary canal of nearly the same intensity as if the poison had been swallowed."

In nearly all reference works, however, the lesions found in the intestines after death from swallowing a poisonous dose of corrosive sublimate are considered amply accounted for by direct contact-

action of the irritant in the course of its passage through the alimentary canal.

Brunton² says: "When swallowed, the mercuric salts cause the symptoms of gastro-enteritis produced by other irritant poisons, but these may be quickly succeeded by the symptoms of special mercuric poisoning from the absorption of the substance into the circulation; thus in the case of corrosive sublimate there may be the metallic taste, sore gums, and profuse salivation characteristic of mercurial poisoning." *

Bartholow³ practically reiterates this statement.

A case of unusual interest in this connection was admitted to the Presbyterian Hospital on January 14, 1897, in the service of Dr. Smith. The following is a brief account of the case:

Case admitted January 14, 1897.

E. H., female, aged thirty; single; employed in housework.

One week before entrance she swallowed twenty grains of corrosive sublimate, mistaking it for a dose of epsom salts. Soon after its ingestion she was seized with severe abdominal pain and vomiting, which continued. The gastric contents were vomited at first, later a considerable quantity of blood.

The vomiting was followed by purging, but the time at which this symptom appeared could not be learned, nor could any account of the treatment before admission be obtained. Until two days before entrance she had some fifteen bloody movements daily, the number then diminishing to about five a day.

On admission the temperature was 100° F.; pulse, 120; respiration, 30. The urine showed a specific gravity of 1017, with five per cent. of albumin, leucocytes and red blood-cells.

Physical examination by house physician: Marked anæmia. Tongue dry, coated with thick fur; small ulcer on its right side. Many extensive sloughs on mucous membrane of fauces and pharynx—the entire fauces being practically covered. Heart: systolic murmur over pulmonic area, action regular; pulse fairly full. Abdomen: some general tenderness, moderate fulness, soft on palpation.

January 15. Vomited about eight ounces of dark blood, with an offensive odor. Hiccoughs. Three hemorrhages from rectum—pure dark blood. During the day vomiting recurred frequently, and

* Fraenkel¹¹ has found that salivation is unusual in corrosive sublimate poisoning from external applications.

violent delirium came on toward night, necessitating the use of the restraining sheet.

January 16. Eight involuntary bloody dejections during the day. Pulse growing more feeble. Continued restlessness.

January 17. Condition unchanged. Eight involuntary bloody stools. Takes little nourishment.

January 18. Became gradually weaker and died at 2.30 P.M.

The temperature was subnormal after admission.

The *post-mortem record* is as follows: Frame, fair size; adipose and muscle development moderate.

Heart, normal. Left lung, in the posterior part of the lower lobe, several hemorrhages. Some thick mucus in the bronchi; some small spots of broncho-pneumonia. Right lung, slight fibrinous exudation on the posterior part. Posterior half of the lower lobe almost entirely hepatized, pale, with hemorrhagic areas; a little of the same in the posterior lower part of the upper lobe.

Gall-bladder contains greenish fluid bile. Liver, consistence normal; surface, smooth and pale; section, pale.

Spleen, consistence tough; surface, smooth, pale; section, pale. Pancreas, normal. Left kidney: ureter and adrenal normal; capsule free, consistence flabby; surface smooth, very pale, with some congested vessels. Markings indistinct, pyramids dark.

Right kidney the same.

Stomach: At about three inches from pylorus on the greater curvature is a large, deep, irregular ulcer with thickened edges. In one portion the floor is extremely thin. At about the middle of the greater curvature are several smaller ulcers. Mucous membrane pale, covered with mucus which contains brown specks. Stomach contains about two ounces of brown fluid with dark specks.

Small intestine appears normal throughout.

Colon: The mucous membrane of the rectum is necrotic in patches. Bulging patches of membrane, partly dark red, partly gray, occur on the tops of the folds all through the remainder of the large intestine. These patches are most numerous at the cæcum and at the hepatic and sigmoid flexures.

Diagnosis.—Corrosive sublimate poisoning, ulcerative gastritis, ulcerative colitis, acute nephritis, acute pneumonitis.

The accompanying photographs of the colon show fairly well the dark patches on the tops of the folds at the cæcum and hepatic flex-

ure. The patches and ulcers in the sigmoid flexure and rectum are less distinctly indicated.

Microscopic examination showed diphtheritic inflammation in the colon and acute nephritis in the kidneys.

In a few places in the kidney sections there was a deposit of some inorganic material in the convoluted tubules, which stained with hæmatoxylin, and corresponded to the descriptions of the lime-salts frequently found in the kidneys after poisoning by corrosive sublimate. It is not intended to enter into this much discussed subject here. The results of exhaustive investigations of these chalky deposits may be found in the works of Kaufmann,¹⁵ Neuberger,¹⁷ Klemperer,¹⁶ and Leutert,²¹ referred to later.

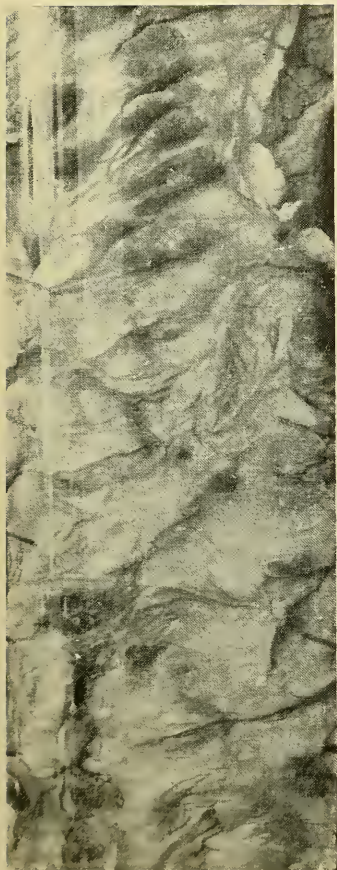
The entire freedom of the small intestine from the effects of the poison in this case, in the presence of such marked changes in the stomach above and in the colon below, was a most striking feature. The lesions in the stomach may be referred to the direct local action of the corrosive sublimate. The large area of deep ulceration spoke for the intensity of this process, as well as for the unusual duration of life (eleven days) after the ingestion of so large a dose. Such deep ulceration of the stomach is said to be rare in these cases, although superficial erosion of the mucous coat is common.⁴ Blyth¹ says that only one case of perforation has been recorded.

The thickened, elevated patches of false membrane in the colon, on the other hand, most marked at the cæcum and rectum, with a few spots of ulceration where the membrane had fallen off, seemed to belong to a wholly different process from that causing the erosions in the gastric mucous membrane; while the absolutely normal appearance of intervening small intestine presented a sharp contrast to both these lesions. The question at once suggested itself: could the contact of the same corrosive agent have caused the widely different changes in the stomach and in the colon, while its presence in the small intestine resulted in no changes at all? In other words, is it probable that any great amount of the unchanged poison could have passed the pyloric orifice?

In considering this question the following facts seemed pertinent:

1. In all cases of irritant poisoning vomiting comes on within a few minutes after the irritant reaches the stomach, and in this way much of the poison is rejected.

2. According to Brunton,² p. 397, "where the poison is exceed-



I.



II.

COLON FROM A CASE OF CORROSIVE SUBLIMATE POISONING.

I. Region of cæcum above, hepatic flexure below. II. Lower portion of sigmoid flexure, ending in rectum below.

ingly corrosive, its local action on the stomach in causing swelling of the mucous membrane may tend partially to occlude the pylorus, and the greater part of the poison may either remain in the stomach itself or be ejected by vomiting without passing into the intestine."

3. Potter⁵ says: "Entering the stomach in any form, mercury becomes a double chloride of sodium and mercury, and unites then with albumin to form a complex molecule of Hg, Na, Cl, and albumin. This is soluble in an excess of sodium chloride or albumin, and is changed in the blood to an oxyalbuminate after its ready absorption in the walls of the stomach. Entering the intestines a purgative action is soon set up, of more or less severity according to the preparation used. A small portion only is absorbed, the rest being converted into a sulphide and excreted with the fæces."

With this account Brunton and other authorities substantially agree. In the intestines, therefore, what little is left of the unchanged or soluble salt, speedily becomes insoluble and therefore non-toxic.*

From these considerations we would expect a less violent action on the mucous lining of the intestines below than on that of the stomach, even in untreated cases of poisoning, and of course the employment of emetics, lavage, albumin, etc., would still further limit the amount of unchanged poison reaching the intestines. These conditions, therefore, might account for the immunity of the small intestine, but would equally exclude the colon from the effects of the contact-action of the corrosive agent.

How then are we to explain the occurrence of the diphtheritic colitis? In this connection the effects following the absorption of bichloride from external applications were recalled. On consulting the literature the lesions described as characteristic of such poisoning were found to correspond exactly with those in this colon.

Direct corrosion of the stomach, therefore, followed by absorption of the poison through its walls into the circulation, and a subsequent croupous inflammation of the colon excited by the presence of the murcury in the blood, would fully account for the widely different appearances in the various portions of the alimentary tract.

As to the rapidity with which such absorption occurs, Bynssen

* See also Liebreich's statements before the Berliner Med. Gesellschaft, November 23, 1887.¹³

(quoted by Blyth¹) found that after giving bichloride to animals by mouth, it could be detected in the urine in two hours and in the saliva in four hours. In from two to four hours, therefore, the poison might be expected to have arrived at the mucous membrane of the colon, even if none had passed the pylorus. As a matter of fact, the numerous records of such cases show that dysenteric symptoms are usually not present until some hours or even days after the ingestion of the poison—although diarrhœa without blood may be an early occurrence^{1, 6, 7}.

The literature on this subject has become very voluminous since the introduction of corrosive sublimate as an antiseptic. Case after case of fatal poisoning has been recorded with varying manifestations at autopsy in the different viscera; but all agree in the main in the distribution of the lesions. Whatever the form of the mercurial and however administered, whether by mouth, rectum, or inunctions, subcutaneously, on dressings, or in irrigating cavities, the stomach and small intestine usually showed little or no change, except for erosions in the former when the poison was swallowed; but in nearly every case which survived longer than two days (and in one case¹¹ in as short a time as twenty-four hours) the characteristic diphtheritic inflammation was present in the colon, and perhaps in the last few inches of the adjacent ileum. In most cases, too, the changes have been most marked at certain definite situations in the colon.

Numerous experiments on animals have still further confirmed the nature and distribution of these lesions.

In 1882 Prevost⁸ published in Switzerland the results of his investigations. He injected corrosive sublimate in a variety of animals and studied its effects on the various organs. He demonstrated the formation of lime-deposits in the kidney tubules and described the diphtheritic inflammation of the colon. It was he who first proposed the hypothesis of the partial elimination of the mercury through the intestinal walls to account for the changes occurring in the colon after such injections.

In 1884 Lomer, at a meeting of the Berliner Gesellschaft für Geburtshilfe und Gynäkologie,⁹ reported from Schröder's clinic the first recorded case due to local application of the bichloride as an antiseptic. A strong solution had been employed for irrigating the wound during operation on a torn perineum. This patient lived

twelve days, during which she had severe dysentery. At autopsy the small intestine showed little change, but the colon was necrotic throughout. Lomer considered this case to be in complete accordance with Virchow's experiments on animals in demonstrating that the lesions in the colon were due to excretion by the mucous membrane of the poison which had been taken up into the general circulation. Schröder also regarded this necrosis as the expression of a general systemic poisoning, and not as the result of the local action of the corrosive sublimate.

In the same year Stadfeldt¹⁰ of Copenhagen published a case of fatal poisoning following irrigation of the uterine cavity with bichloride, which attracted general attention to the danger of this proceeding. In this case, too, the colitis was the striking feature.

Following him, Fraenkel¹¹ in 1885 reported a series of seven autopsies on cases poisoned by the external use of the bichloride as an antiseptic. He found the colon extensively involved in nearly every case. The small intestine was only exceptionally affected, and then near the cæcum.

He pointed out that salivation is rare in sublimate poisoning. He believes that the cæcum is first attacked by the corrosive action of the salt, and the lesions at this situation are therefore found to be partly healed when death occurs, while the rectum, having been invaded later, shows at autopsy a greater degree of inflammation. He concludes that these cases of intestinal lesion with necrosis of the mucous membrane constitute a disease caused by the absorption of the sublimate and its subsequent elimination from the intestines. The diphtheritic inflammation of the colon is therefore the danger chiefly to be feared from the immoderate use of bichloride as an antiseptic.

Peabody¹² reported a number of similar cases from the New York Hospital in the same year.

Virchow¹³ in 1887 exhibited at a meeting of the Berliner Medicinische Gesellschaft the colon from a case poisoned by the use of bichloride as an antiseptic. He stated that according to Liebreich's experiments on animals the process in the colon begins as a congestion of the folds, then swelling, then œdema of the submucosa, and finally hemorrhagic infiltration. On these spots the bacteria present in the intestine settle and produce diphtheritic inflammation. The sublimate thus effects changes in the tissues so as to afford a

favorable nidus for the development of bacteria. He knew no way of distinguishing anatomically the colitis of sublimate poisoning from genuine dysenteric diphtheria. He surmised that many cases of dysentery had thus been referred to the wrong cause.

Liebreich and Senator at the same meeting reported cases in both of which, although the bichloride was swallowed, little or no change was produced in the stomach or small intestine, but extensive lesions occurred in the colon. This result was regarded as an argument against local corrosive action in the intestine and in favor of elimination by the mucous membrane of the colon after absorption in the stomach.

In January, 1888, Virchow reported three more cases, in one of which there were changes in the ileum, but none in the colon.

In November, 1888, Virchow exhibited specimens from a case in which the cyanide of mercury had been taken by mouth. No evidences of corrosion appeared in the mouth, pharynx, œsophagus, or stomach, but the colon showed marked diphtheritic inflammation at the cæcum, hepatic and splenic flexures, and in the rectum, the intervening portions being comparatively unchanged. The rectum, as in Fraenkel's cases, was the part most effected. Virchow considered these appearances sufficient evidence that the lesions were not caused by direct contact with the poison, but occurred in some other way.

In the same year Grawitz,¹⁴ by a clever experiment, proved conclusively that the colitis was not due to simple contact-action of the poison excreted in the fæces and bile.

He divided the colon in a dog a short distance above the cæcum, closed the distal end and returned this portion to the abdominal cavity. With the proximal end he made an artificial anus. He then injected bichloride subcutaneously. In due time bloody discharges came through the rectum from the blind pouch formed by the colon—while all the fæces and bile were diverted through the artificial anus. The excluded colon showed typical diphtheritic inflammation. Grawitz considers this process therefore to be not a corrosion, but an erosion similar to that occurring on the tops of the rugæ in the stomach, where cramp-like contraction of the muscularis caused by extreme hyperæmia produces hemorrhagic infiltration in the folds. The summits of these rugæ are then digested or become necrotic, and erosions ensue. In the same way in the in-

testine, the mercury in the blood, whether sublimate or albuminate does not matter, stimulates the muscularis to cramp-like contraction. Hemorrhage then occurs into the tops of the folds from the engorged vessels, and on these spots the bacteria present in the intestine settle and excite diphtheritic inflammation. He remarks the interesting fact that in epidemic dysentery not only are the lesions identical, as Virchow noted, but the mechanical conditions of muscular cramp with consequent engorgement and hemorrhage are exactly similar. He considers this an indication that epidemic dysentery is a general infection in which the toxic substances are eliminated from the blood through the intestinal wall and so produce exactly the same changes as occur in poisoning by mercury. He concludes that any diphtheritic inflammation limited to the tops of the folds in the colon points to the excretion through the intestinal mucous membrane from the blood of an irritating substance capable of causing inflammation.

Kaufmann¹⁵ in 1888 published the results of elaborate experiments on animals and of observations in cases of poisoning, and formulated a theory to account for the occurrence of the lesions in the various organs. He claims that the nature of the sublimate intoxication is an alteration of the blood by the poison. By reason of changes in the red cells, or of the formation of a fibrin ferment by the action of the mercury, or as a result of both these factors, thromboses occur in the vessels of the affected organs. After very large doses in animals he found large coagula in the heart and great vessels which he regarded as the cause of the speedy death. In more chronic cases he believes he could demonstrate that the thrombosis occurred in the capillaries instead of in the large vessels. This capillary plugging resulted in stasis, diapedetic hemorrhage and necrosis in the areas involved. Such areas were found in the intestine at the tops of the folds, where the tendency to thrombosis is further favored by muscular cramp and consequent congestion, as remarked by Grawitz.¹⁴ On such necrotic or non-resistant portions of tissue the bacteria grow and excite a secondary inflammation of a dysenteric character, as suggested by Virchow.¹³ Similar areas of capillary stasis in the kidneys lead to degeneration and necrosis of the epithelium in the tubules, in which then chalky deposits occur.

After the appearance of his book he published a case in which

no changes whatever were to be found in the colon. This result, in accordance with his theory of blood-poisoning with consequent thrombosis and stasis, he regarded as due to the fact that for some inexplicable reason capillary obstruction had not taken place in the colon in this case. The resulting stasis, necrosis, and secondary inflammation from bacterial invasion were therefore absent also. He remarks in this connection, "If the intestinal lesions were caused by a local corrosive action, this result would be incomprehensible—for why should the intestine, which is the main channel for the excretion of mercury, be spared from such corrosive action in this instance?" He also states that the intestine owes in great part its content of mercury to the bile—an idea which undoubtedly kept alive the "local corrosion" theory for a long time, until Grawitz's experiment disproved it. More recently Ludwig¹⁸ has found that there is little or no mercury present in the bile in corrosive sublimate poisoning.

Kaufmann's explanation of the action of the sublimate has not met with general acceptance, although the value of his investigations is freely granted.

Klemperer¹⁶ also experimented on animals and collected statistics from a large number of reported cases of poisoning, with especial reference to the calcareous and other changes in the kidneys. He quotes a case in which the poison after being swallowed was so quickly and thoroughly removed that no actual poisoning in the sense of "intoxication" occurred. The diarrhoea and the presence of mercury in the stools in this case indicated merely the mechanical excretion of the irritant, and not an actual secretion by the intestinal wall. He pointed out that more than half the mercury which actually gets into the blood is eliminated by the kidneys. He concludes that there is no characteristic "sublimate kidney," in the sense that only sublimate can cause the changes found.

Neuberger has also made a special study of the kidney lesions in sublimate poisoning.

Ludwig,¹⁸ in Vienna, has thrown much light on the distribution of the poison after absorption, by chemical analyses of the various organs. He arrived at his results by a long series of experiments on animals, and by analysis of the tissues in nine cases of poisoning by mercury in man. He found that the localization of the poison in these cases after uterine irrigation, after taking the sulphate by

mouth, and after subcutaneous injections of gray oil, is quite similar to that resulting from swallowing the sublimate. The experiments on animals gave corresponding results.

The kidneys and liver showed the presence of the greatest proportion of the mercury--the intestines being the next in order. The quantity in the tissues of the colon was much greater than in the small intestine, except when death followed immediately after ingestion of the poison, when the content is of course greater in the upper part of the alimentary tract.

The bile was found to contain little or no mercury, and in the single case in which the salivary glands were examined, none of the poison could be detected in this tissue.

In cases surviving for some time, therefore, the relatively greater quantity of the toxic agent present in the tissues of the colon corresponds perfectly to the marked changes which are almost invariably found there.

Gebhard,¹⁹ in 1891, published the results of his investigations and reported a case showing perhaps the most profound changes in the colon of any thus far recorded. This patient had lived eight days. At autopsy there was extensive necrotic ulceration from the anus to 10 cm. above the ileo-cæcal valve, this whole tract being covered with greenish-black incrustation. At the sigmoid flexure was an ulcer which had perforated into the peritoneal cavity. The intensity of the process was most marked at this situation, but became less and less severe toward the ileum.

Gebhard considered the clinical manifestations from the various organs to occur in the following order: (1) Diarrhœa. (2) Changes in the uropoietic system. (3) Stomatitis.

In the same year Weichselbaum,²⁰ in Vienna, published a resumé of the whole subject of mercurial poisoning, as understood at that time, and reported additional cases. He considers that the renal and intestinal lesions are not pathognomonic of mercurial poisoning, but may occur under many different conditions. He believes the processes in the intestine and kidney are due to the direct action of the mercury on the tissues of those organs during its elimination.

The most recent work on this subject has been done by Leutert²¹ within the last few years. He undertook his investigations partly because Kaufmann's theory had proven so unsatisfactory, but chiefly on account of the tendency among clinical observers to refer symp-

toms characteristic of mercurial poisoning to some other cause. He made an elaborate series of experiments on animals and recorded some new cases in man.

As the result of his work he proposes a new hypothesis to explain the appearances in sublimate poisoning, and has tabulated sixty-two recorded cases, with the conditions of their occurrence and the post-mortem lesions; to substantiate his views. He believes that all these appearances may be referred to one or the other of two factors, or to a combination of both. These are :

1. The direct toxic action of the mercury on the walls of the blood-vessels and on the tissues of the various organs.
2. Alterations in the blood-pressure following weakened heart-action due to toxic action on the centres and on the heart itself.

He considers he has demonstrated that the presence of the mercury in the blood increases the permeability of the walls of the blood-vessels, thus leading to hemorrhages in different organs, even into the skin. The poisoned blood can also cause fatty degeneration of the heart-muscle. The calcareous and other changes in the kidneys result directly from the poisonous action of the excreted mercury.

As to the lesions in the intestine, he agrees fully with Grawitz and Kaufmann that corrosive action extending from the lumen outward, during the passage of the excreted mercury through the colon, is ruled out. He holds, however, to the corrosive property of the eliminated poison when it passes in the opposite direction, from the blood-vessels inward, it being then squeezed into the lumen by the cramp-like contraction of the muscularis. The poison passing thus with the serum through the walls of the vessels effects direct injury to their cells, whereby further exudation and hemorrhage are favored. These phenomena occur only when marked congestion, due to the weakened heart-action, exists in the intestinal walls.

The diphtheritic inflammation, he claims, arises solely from the persistence of the corrosion action for a considerable time, and in the absence of substances on the mucous membrane which oppose this action. Maschka²³ has found diphtheritic inflammation in the stomach. This organ, however, is usually protected by reason of the short time during which the poison remains there, and on account of neutralizing substances present in its cavity; otherwise croupous inflammation would frequently be met with here also. The small intestine shows a relative immunity, because of its better cir-

culation, the colon being more subject to congestion on account of its situation. The colon, however, is especially the seat of the inflammatory process by reason of the strength of its muscular coats, the cramp-like contractions of which hinder in a high degree the return current of the blood from the folds. These contractions would be most powerful where there is greatest resistance to be overcome, *i.e.*, at the flexures and the ileo-cæcal valve. The flexures, too, are fixed, and the muscles therefore act here to greatest advantage. The rectum is affected last because the factors favoring the occurrence of inflammation in the flexures are here absent in part, so that changes do not ensue until there is a very great fall in the blood-pressure—a short time before death and especially after severe poisoning.

Leutert rejects Kaufmann's theory of thrombosis, considering the coagula and thrombi found by Kaufmann to be the result of the failing heart-action in the dying animal.

He concludes: 1. The appearances in the organs as well as the lime-deposits are due to the direct toxic action of the mercury; the varying manifestations of this action in kidneys and intestine, to variations in the blood-pressure; and the changes in the quantity of urine, to both.

2. Inflammatory processes appear in the intestine when the dose relative to the resistance of the individual is so great that the heart-action is weakened and the blood-pressure falls. With normal blood-pressure the kidneys will continue to excrete; when this is lowered the task of excretion falls on the mucous membrane of the intestine. Thus a weak heart will react to a large dose and cause rapid sinking of the blood-pressure, so that in twenty-four hours marked changes will be present in the mucous membrane of the colon, as in Fraenkel's case.¹¹ In the presence of disease in the heart or kidneys, therefore, a moderate dose may cause severe lesions in the intestine.

In conclusion, we may summarize our study of the subject as follows:

1. The classification of corrosive sublimate as a purely irritant poison, causing corrosion throughout the alimentary canal by direct contact-action, is erroneous.

2. Diphtheritic colitis is a very constant lesion in cases of in-

toxication following the absorption of mercury in any form from any part of the body.

3. The danger of mercurial toxæmia from the use of bichloride dressings and irrigations is by no means a remote one, and the occurrence of dysentery under such circumstances should be referred to its true cause.

4. The existence of cardiac or renal lesions should lead to great caution in the administration of mercury.

5. Our knowledge of epidemic dysentery (in which the diphtheritic form of colitis predominates*) might be furthered more effectually by clinical and pathological studies undertaken from the stand-point of a toxæmia, than by continuing to regard this disease as due to the local action of toxic agents introduced into the alimentary canal.

BIBLIOGRAPHY.

1. BLYTH: Poisons, their Effects and Detection. Wood's Library, 1885.
2. BRUNTON: Pharmacology, Therapeutics, and Materia Medica. Third edition, 1889.
3. BARTHOLOW: Materia Medica and Therapeutics. Eighth edition, 1895.
4. Quain's Dictionary of Medicine. Article "Mercury."
5. POTTER: Materia Medica, Pharmacology, and Therapeutics. 1897.
6. Lancet 1845. Vol. ii., p. 700.
7. VON JAKSCH: In Nothnagel's "Specielle Pathologie und Therapie." Wien 1897.
8. PREVOST: Étude expérimentelle relative à l'intoxication par la mercure. Rev. méd. de la Suisse Rom., 1882, Nos. 11 and 12; and 1883, No. 1. Reviewed in Centralbl. für klin. med., 1883, vol. iv., p. 531.
9. LOMER: Sitzung der Berliner Gesellschaft für Geburtshilfe und Gynäkologie, January 25, 1884. Reported in Zeitschr. z. Geburtsh. u. Gynäk., 1884, vol. x., p. 351.
10. STADFELDT: Sind als Desinficiens in der Geburtshilfe Sublimatlösungen der Carbolsäure vorzuziehen? Centralbl. f. Gynäk., 1884, vol. viii, No. 7, p. 97.
11. FRAENKEL: Ueber toxische Enteritis in Gefolge der Sublimatwundbehandlung. Virchow's Archiv, 1885, vol. xcix, p. 276.
12. PEABODY: Toxic Enteritis Caused by Corrosive Sublimate as a Surgical Dressing. New York Medical Record, March 14, 1885.
13. VIRCHOW: Sitzung der Berliner Med. Gesellschaft, November 23, 1887, January 4, 1888, and November 21, 1888. Reported in Berliner klin. Woch., 1887, vol. xxiv, p. 953, and 1888, vol. xxv, pp. 71 and 1017.

* See Davidson's article on "Dysentery," Allbutt's System of Medicine, vol. ii., p. 421.

14. GRAWITZ : Ueber die Dickdarmentzündung bei acuter Quecksilbervergiftung. Deutsch. Med. Woch., 1888, No. 3.
15. KAUFMANN : "Die Sublimatintoxication." Berlin, 1888. Also, Neuer Beitrag zur Sublimatintoxication nebst Bemerkungen über die Sublimatniere. Virchow's Archivl, 1889, vol. cxvii, p. 233.
16. KLEMPERER : Ueber die Veränderung der Nieren bei Sublimatintoxication. Virchow's Archiv, vol. cxviii, 1890, p. 449.
17. NEUBERGER : Ueber die Wirkung des Sublimats auf die Niere beim Menschen und beim Thiere. Ziegler's Beiträge zur Path. anat. u. z. all. Path., 1889, vol. vi, p. 429.
18. LUDWIG : Ueber die Localization des Quecksilbers in thierischen Organismus nach Vergiftung mit Ätzsublimat. Wiener klin. Woch., 1889, No. 45 ; 1890, Nos. 28 and 32.
19. GEBHARD : Ueber Sublimatintoxication. Zeitschr. für Geburtsh. und Gynäkol., 1891, vol. xxi, p. 251.
20. WEICHSELBAUM : Der Gegenwartige Stand unserer Kenntnisse über die anatomischen Veränderungen bei Quecksilbervergiftung. Centralbl. f. Allg. Path. u. Path. Anat., 1891, vol. ii., Nos. 1 and 2, pp. 7 and 59.
21. LEUTERT : Ueber die Sublimatintoxication. Fortschritte der Medicin, 1895, vol. xiii, pp. 89, 129, 169, 209, 249, 293, 333, 373, 421.
22. MASCHKA : Prager Med. Woch., 1884, No. 5.

XIX.

A CASE SHOWING EXTREME LEUKÆMIC OR LYMPHOID INFILTRATION OF THE VISCERA.

BY J. S. THACHER, M.D.

ALTHOUGH the complete details of the case are not available, it seems best to put on record the accompanying photographs and



FIG. 1.—PHOTOGRAPH OF SECTION OF HEART MUSCLE.

drawings. They show a high degree of infiltration of heart, liver, and kidney by what is evidently lymphoid tissue or an army of

lymphocytes. As the patient was in the hospital only a few hours, and those at night, the history obtained was imperfect and the examination incomplete. And as the nature of the case was only realized when the routine sections of the organs were looked over some days after the autopsy, the pathological investigation also left much to be desired. The sections in themselves, however, are in-

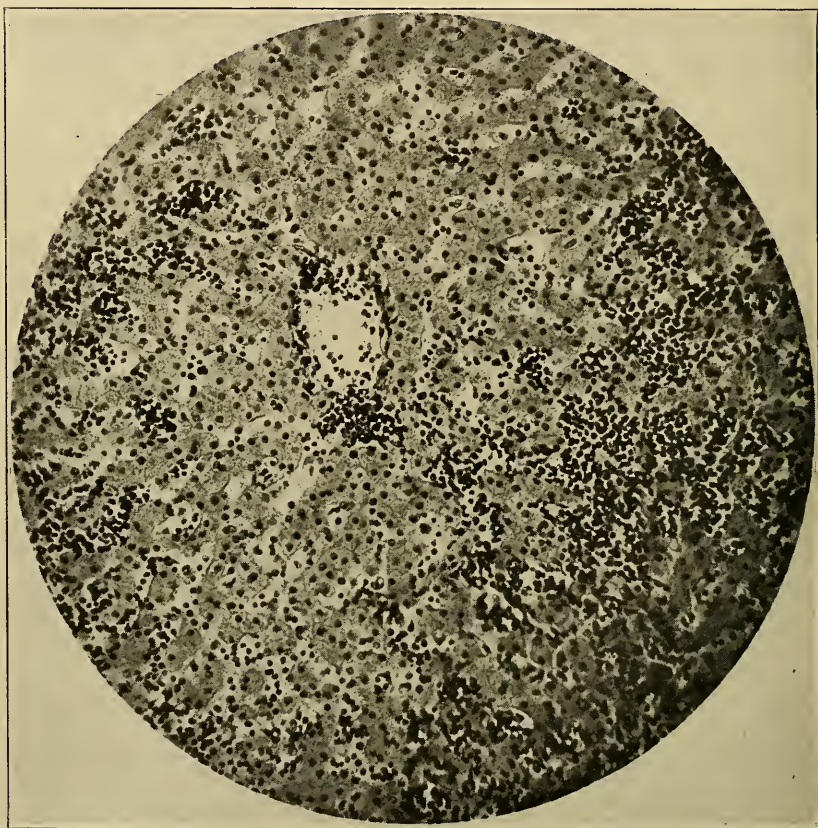


FIG. 2.—PHOTOGRAPH OF SECTION OF LIVER.

teresting as examples of the extent to which this lymphoid infiltration can go.

The patient, E. B., a girl three and one-half years old, was brought to the hospital at half-past seven in the evening and died the following morning at five.

For several months she had been in failing health and had looked pale. About a month before death she began to have chills, fever, and sweating at irregular times. She soon became profoundly anæmic. Several times her dejections contained blood, and three days before her death she vomited blood. Before coming to the hospital she was treated for malarial fever.



FIG. 3.—PHOTOGRAPH OF SECTION OF KIDNEY.

On admission to the hospital she was of a dirty sallow color, appearing anæmic and cachectic. The spleen was found to be very large, the abdomen distended. After an enema she had a dejection containing blood and mucus. The temperature was 100° F., and

later 104.5° F. Her pulse ranged from 155 to 200, the respirations from 30 to 60.

At the autopsy the development of adipose was moderate, that of the muscles good. The most striking appearance on examining



FIG. 4.—DRAWING OF SECTION OF LIVER.

the viscera, besides the large spleen, was the presence of numerous ecchymoses. They were found beneath the pericardium, pleura, and endocardium, in the omentum, in the mucous membrane of the stomach, beneath the capsule of the kidney, in the kidney tissue,

and in the lung tissue. There was also some extravasation of blood into the connective tissue of the hilum of the kidney. The heart-muscle appeared fatty. The mesenteric glands were enlarged.

Microscopical examination of blood from the heart discovered an abnormal abundance of white cells.

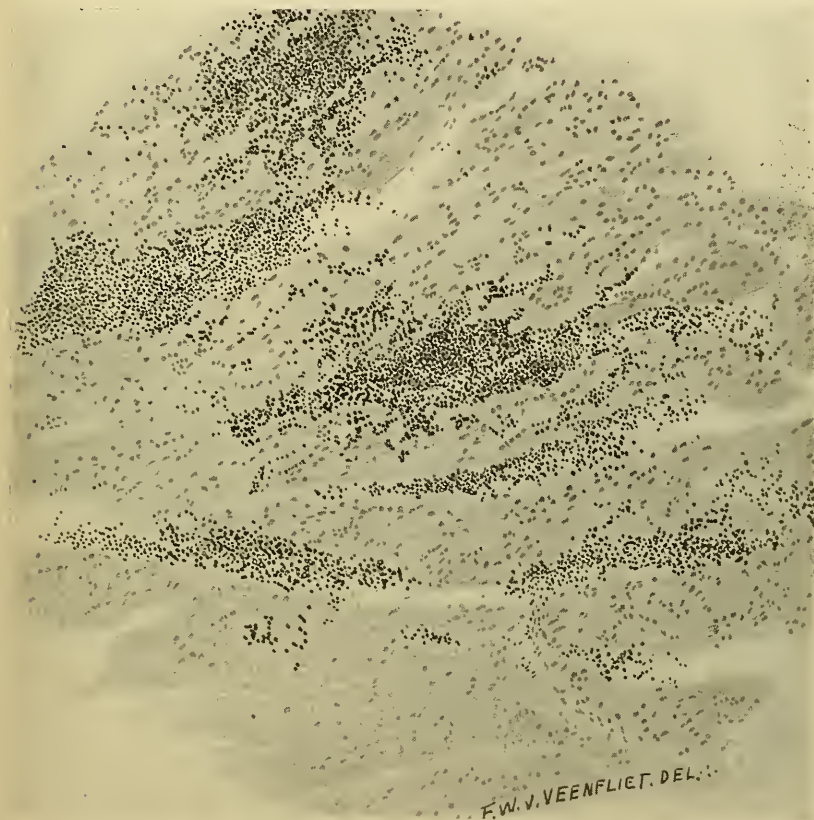


FIG. 5.—DRAWING OF SECTION OF HEART MUSCLE.

Cultures from lungs, liver, spleen, and kidneys all showed pure growths of cocci in short chains. Microscopical examination of sections of heart, liver, kidney, and stomach showed, in all these organs, areas of crowded small cells. The nuclei were, as a rule, small, with smooth, round, or oval outlines, and granular contents staining rather deeply with hæmatoxylin. Among them there were

in some of the groups irregular, crumpled, or broken nuclei, very deeply stained ; in places many minute, irregular, dark-blue particles supposed to be nuclear fragments. A small number of the nuclei resembled those of polynuclear leucocytes, but the usual appearance was that of lymphocytes. The cell-bodies were not appreciable, nor could any fibres be detected between the cells except where they had invaded fibrous tissue. These cellular areas were very abundant in the liver and kidney, occupying about one-third of the total area of the liver-sections examined, and about one-half the area of the kidney-sections. In the heart and stomach they were much less abundant. In the liver the cellular invasion was found chiefly between the lobules and in the outer parts of the lobules, but was not confined to those situations. In the kidney, heart, and stomach the distribution was irregular. The proper tissue of the organs seemed to be scarcely affected by the presence of these cellular masses. In one or two places in the heart-sections the neighboring muscle-cells showed some granular degeneration and the disappearance of a few nuclei, but, as a rule, the heart-muscle, where invaded by these-cells, showed no further change than a slightly yellowish tinge to the eosin stain. A few nuclei of liver-cells were swollen and very lightly stained. The tubules and tufts of the kidney showed very little change, even where they were found isolated in dense masses of the invading cells. Some of the tubules, however, were a little dilated, containing a little granular and globular material.

From the character of the cells, their abundant presence in large groups, their general distribution, and the absence of change in the invaded tissues, the appearances are judged to be not those of inflammatory exudation, but those of a leukæmic or lymphoid infiltration. The photographs were made by Dr. Edward Leaming, the drawings by Mr. F. W. J. Veenfliet.

XX.

A REPORT OF TWENTY-SEVEN CASES OF PNEUMONIA FOLLOWING THE INHALATION OF ETHER AND CHLOROFORM.

BY ERNEST C. SCHULTZE, M.D.

PNEUMONIA, which so frequently follows the use of chloroform and ether as an anæsthetic and so often proves fatal, has apparently been passed by for years almost unnoticed, and certainly for a subject so important has received less attention than it deserves.

Gerster (*Medical Record*, April 23, 1887) reports 6 cases of pneumonia following operations, also 4 more cases following operations performed on the trachea, tongue, and lower jaw.

In the ten years from September 1, 1887, to September 1, 1897, in the Presbyterian Hospital there were found to have followed operations, 27 cases of pneumonia. These have been divided into two classes. It will be thus seen that 20 cases of pneumonia followed operation, where there was no injury directly traceable to lung or upper respiratory tract, while 7 cases were either operations upon tongue, trachea, or injuries to chest, and possibly of the kind called by the Germans "Schluck-pneumonie."

CLASS I.

No Injury to Upper Respiratory Tract, Chest, or Lung.

- Compound fracture of tibia, one case.
- Inguinal adenitis, one case.
- Amputation of thigh, one case.
- Compound fracture of tibia and fibula, one case.
- Mastoiditis, one case.
- Carcinoma of the sacrum, one case.
- Lacerated cervix and perineum, one case.
- Exploratory cœliotomy, one case.
- Cœliotomy for stab-wound of abdomen, one case.
- Extra-uterine gestation, one case.
- Axillary abscess, one case.

Compound comminuted fracture of right leg, one case.
 External urethrotomy for chronic cystitis, one case.
 Fibroid of uterus, two cases.
 Cæliotomy for intestinal obstruction, one case.
 Compound fracture of skull, one case.
 Appendicitis, two cases.
 Retroversion of uterus and lacerated perineum, one case.

CLASS II.

Injury to Tongue, Trachea, Chest, or Lung.

Œdema of glottis (tracheotomy operation), one case.
 Fracture of spine, fracture of tibia and fibula, fracture of ribs, one case.
 Pistol-shot wound of the chest, one case.
 Epithelioma of the tongue (tracheotomy), one case.
 Incised wound of the neck (tracheotomy), one case.
 Compound depressed fracture of the skull, fracture of ribs, one case.
 Sarcoma of the larynx, one case.

During the ten years the following table shows how often ether and chloroform have been administered to patients in the Presbyterian Hospital.

	1887- 90	1891	1892	1893	1894	1895	1896	1897	Totals
Ether administered to patients.....	980	415	527	548	570	629	615	630	4,914
Chloroform administered to patients.....	15	5	24	124	105	89	148	179	689
Ether and chloroform administered to patients.....	2	8	6	3	45	15	23	14	116
Alcohol, ether, and chloroform administered to patients.....		1							1
Ether and oxygen administered to patients.....							3		3
Chloroform and cocaine administered to patients.....							1		1

Thus ether was administered in 4,914 cases; chloroform, 689 times; chloroform and ether, 116; alcohol, ether, and chloroform, 1; ether and oxygen, 3; chloroform and cocaine, 1; making a grand total of chloroform and ether narcotizations to the number of 5,724 cases. Of these, 27 developed a pneumonia, a percentage of 0.47 per cent.

	Cases.	Cured.	Died.
Pneumonia followed the administration of ether.....	17	8	9
Pneumonia followed the administration of chloroform.....	8	1	7
Pneumonia followed the administration of chloroform and ether.....	2	0	2

Exam- on.	Highest Temperature, degrees Fahr., Pulse, Respiration.	Duration.	Result.	Autopsy, when made.	State of Lungs.
per lobe, r.	Feb. 22: temp., 102; pulse, 108; resp., 32.	9 days...	Cured.		
ver lobe, or.	May 18: temp., 103; pulse, 160; resp., 36.	5 days...	*May 18, 1891...	No autopsy allowed.	
right posterior.	Jan. 9: temp., 105; pulse, 140; resp., 36.	7 days...	*Jan. 9, 1892....	No autopsy allowed.	
left chest ry line.	April 1: temp., 105; pulse, 160; resp., 60.	10 days..	*April 2, 1892....	No autopsy allowed.	
left low- er lobe.	Nov. 9: temp., 105; pulse, 136; resp., 38.	2 days...	*Nov. 11, 1892...	24 hours later.	Upper half of left lower lobe hepatized, red and gray. Rest of lung, moderate congestion and oedema. Right lung, a few adhesions.
ght lung, r.	March 13: temp., 105.5; pulse, 140; resp., 40.	8 days...	*March 15, 1893..	No autopsy allowed.	
per lobe..	June 6: temp., 105.8; pulse, 140; resp., 56.	3 days...	*March 27, 1893..	28 hours later.	Lobes of left lung congested and oedematous. Kidneys had cloudy appearance.
per lobe..	June 6: temp., 105.8; pulse, 140; resp., 56.	6 days...	*June 9, 1893....	24 hours later.	Lobar pneumonia of right upper lobe.
ft lobe, or.	Oct. 21: temp., 103.5; pulse, 140; resp., 40.	5 days...	Cured.		
ver lobe, or.	Jan. 6: temp., 103.8; pulse, 132; resp., 32.	21 days..	Cured.		
r lobe...	May 29: temp., 107.5; resp., 50; no pulse re- corded.	14 days..	*May 29, 1894....	No autopsy allowed.	
er lobe, or.	Feb. 3: temp., 106; pulse, 158; resp., 58.	5 days...	*Feb. 5, 1895....	No autopsy allowed.	
ver lobe, or.	April 6: temp., 104; pulse, 118; resp., 44.	8 days...	Cured.		
l.....	May 17: temp., 106; pulse, 150; resp., 40.	3 days...	*May 18, 1895....	.....	Through part of right upper lobe, and whole of lower lobe, numerous small areas of broncho-pneumonia. Lung compressed and un-aerated.
er lobes. or.	Aug. 5: temp., 103; pulse, 108; resp., 36.	14 days..	Cured.		
g, ante- rior.	Sept. 8: temp., 108; pulse, 142; resp., 56.	4 days..	*Sept. 8, 1895....	No autopsy allowed.	
pneumo- nith lungs.	Nov. 3: temp., 105; pulse, 130; resp., 40.	9 days...	*Oct. 30, 1895...	No autopsy allowed.	
ver lobe, or.	Nov. 24: temp., 106.8; resp., 40; no pulse noted.	48 hours..	*Nov. 24, 1895...	No autopsy allowed.	
ver lobe, or.	April 30: temp., 104; pulse, 118; resp., 40.	5 days...	Cured.		
ddle lobe, or.	Jan. 1: temp., 104; pulse, 118; resp., 36.	9 days...	Cured.		
g, ante- rior.	July 16: temp., 104.5; pulse, 140; resp., 38.	6 days...	*July 16, 1891....	No autopsy allowed.	
6th, 9th ht chest, 7 line.	Nov. 26: temp., 106.6; pulse, 126; resp., 36.	7 days...	*Nov. 26, 1891...	24 hours later.	Right lung, seat of extensive broncho-pneumonia.
ver lobe, or.	Jan. 13: temp., 104.5; pulse, 124; resp., 56.	25 days..	Cured.		
l.....	Oct. 25: temp., 103; pulse, 130; resp., 72.	8 days...	*Oct. 26, 1894....	27 hours later.	Right and left lung, seat of broncho-pneumonia.
er lobes, or.	Feb. 19: temp., 103.8; pulse, 140; resp., 36.	2 days...	*Feb. 19, 1895...	24 hours later.	Congestion of both lower lobes.
ver lobe, or.	Jan. 19: temp., 102.8; pulse, 140; resp., 36.	10 days..	Cured.		
l.....	May 13: temp., 103.5; resp., 68; no pulse re- corded.	4 days...	*May 13, 1896...	24 hours later.	A small patch of pneumonia, about 1 inch in diameter at lower edge of inferior right lobe. Left lobe congested.

TABLE I.

Case No. and Initials.	Age.	Date of Admission.	Family History.	Previous History.	State on Admission.	Anæsthetic.	Operation.	Urinæ.	Before Operation.	After Operation.	Condition 24 hours after Operation.	Chill.	First Symptom of Pneumonia.	Physical Examination.	Highest Temperature, degrees Fahr., Pulse, Respiration.	Duration.	Result.	Autopsy, when made.	State of Lungs.
1. W. H., m.	28	Feb. 29, 1890.	Negative.	Negative.	Slight shock.	Chloroform.	Feb. 19, injuries dressed.	Negative.	Negative.	Negative.	Good.	No.	36 hours following operation.	Right upper lobe, anterior.	Feb. 22: temp., 102; pulse, 108; resp., 32.	9 days.	Cured.		
2. R. M., m.	38	May 2, 1891.	Negative.	Negative.	Good.	Ether.	May 5, excision of inguinal glands.	Negative.	Negative.	Negative.	Fair.	Yes.	7 days following operation.	Right lower lobe, posterior.	May 18: temp., 103; pulse, 106; resp., 36.	5 days.	*May 18, 1891.	No autopsy allowed.	
3. M. K., m.	38	Dec. 5, 1891.	Tubercular.	Negative.	Fair.	Ether.	Dec. 7, amputation of thigh, middle and lower third.	Negative.	Negative.	Negative.	Good.	Yes.	25 days following operation.	Dulness, right apex, posterior.	Jan. 9: temp., 105; pulse, 140; resp., 36.	7 days.	*Jan. 9, 1892.	No autopsy allowed.	
4. A. M., m.	31	March 22, 1892.	No record.	No record.	Slight shock.	Ether.	March 29, cataplectic dressing, plaster splint applied.	Negative.	Negative.	Negative.	Good.	No.	48 hours following operation.	Dulness, left chest in axillary line.	April 1: temp., 105; pulse, 160; resp., 60.	10 days.	*April 9, 1892.	No autopsy allowed.	
5. M. D., f.	37	Nov. 9, 1892.	Negative.	Alcoholic.	Fair.	Chloroform.	Nov. 9, trephining for mastoid abscess.	Albumin, twenty-five per cent.	No record.	No record.	Good.	No.	No record.	Dulness, left lower lobe.	Nov. 9: temp., 105; pulse, 135; resp., 38.	2 days.	*Nov. 11, 1892.	24 hours later.	Upper half of left lower lobe hyperaemic, red and gray. Rest of lung, moderate congestion and oedema. Right lung, a few adhesions.
6. T. O'W., m.	38	Feb. 27, 1893.	Negative.	Negative until four months before admission.	Good.	Ether.	March 7, resection of sacrum.	Negative.	Negative.	Negative.	Good.	No.	60 hours following operation.	Base of right lung, anterior.	March 13: temp., 105.5; pulse, 140; resp., 40.	8 days.	*March 15, 1893.	No autopsy allowed.	
7. A. B., f.	40	March 17, 1893.	Tubercular.	Negative.	Good.	Ether.	March 24, Bischoff's operation.	Negative.	Negative.	Negative.	Poor.	No.	No record.	Right upper lobe.	June 6: temp., 105.8; pulse, 140; resp., 36.	3 days.	*March 27, 1893.	28 hours later.	Lobes of left lung congested and oedematous. Kidneys had cloudy appearance.
8. M. H., m.	26	June 1, 1893.	Negative.	Pneumonia, May 14, 1893.	Good.	Chloroform and ether.	June 3, calectomy, nephrectomy.	Trace of albumin.	Negative.	Negative.	Poor.	No.	No record.	Right upper lobe.	June 6: temp., 105.8; pulse, 140; resp., 36.	6 days.	*June 9, 1893.	24 hours later.	Lobar pneumonia of right upper lobe.
9. D. M., m.	21	Oct. 20, 1893.	Negative.	Negative.	Good.	Ether.	Oct. 24, calectomy.	Negative.	Negative.	Negative.	Good.	No.	20 hours following operation.	Upper left lobe, posterior.	Oct. 21: temp., 103.5; pulse, 130; resp., 40.	5 days.	Cured.		
10. M. G., f.	27	Jan. 1, 1894.	Negative.	Negative.	Good.	Ether.	Jan. 3, oophorectomy.	Negative.	Negative.	Negative.	Good.	No.	120 hours following operation.	Right lower lobe, posterior.	Jan. 6: temp., 103.8; pulse, 130; resp., 32.	21 days.	Cured.		
11. J. B., m.	25	May 9, 1894.	Negative.	Entered medical division, May 7, 1894, with history of severe headache, temp., 104° F.; pulse, 108; resp., 36.	Transferred to surgical division, May 9, with large axillary abscess.	Ether.	May 9, incision and drainage.	Negative.	Negative.	Negative.	Poor.	No.	120 hours following operation.	Left lower lobe.	May 29: temp., 107.5; resp., 50; no pulse recorded.	14 days.	*May 29, 1894.	No autopsy allowed.	
12. J. B., m.	26	Jan. 28, 1895.	Negative.	Negative.	Good.	Chloroform.	Jan. 30, amputation of leg.	Negative.	Negative.	Negative.	Good.	No.	48 hours following operation.	Left lower lobe, posterior.	Feb. 3: temp., 106; pulse, 158; resp., 56.	5 days.	*Feb. 5, 1895.	No autopsy allowed.	
13. W. S., m.	33	March 30, 1895.	Negative.	Negative.	Fair.	Ether.	March 30, external urethrotomy.	Albumin, four per cent.	No record.	No record.	Good.	No.	56 hours following operation.	Right lower lobe, posterior.	April 6: temp., 104; pulse, 118; resp., 44.	8 days.	Cured.		
14. A. B., f.	24	May 14, 1895.	No record.	No record.	Poor.	Chloroform.	May 14, wound probed.	No record.	No record.	No record.	Good.	No.	No record.	No record.	May 17: temp., 106; pulse, 150; resp., 40.	3 days.	*May 18, 1895.		Through part of right upper lobe, and whole of lower lobe, numerous small areas of broncho-pneumonia. Lung compressed and unresistant.
15. L. J., f.	36	July 15, 1895.	Negative.	Negative.	Fair.	Ether.	July 15, for appendicitis.	Negative.	Negative.	No record.	No.	No.	14 days following operation.	Both lower lobes.	Aug. 5: temp., 103; pulse, 108; resp., 36.	14 days.	Cured.		
16. R. M., m.	18	Sept. 4, 1895.	Negative.	Negative.	Poor.	Ether.	Sept. 4, appendicectomy.	Trace of sugar.	No record.	No record.	Yes.	Yes.	48 hours following operation.	Right lung, anterior.	Sept. 8: temp., 108; pulse, 142; resp., 36.	4 days.	*Sept. 8, 1895.	No autopsy allowed.	
17. A. A., f.	53	Oct. 23, 1895.	Negative.	Negative.	Good.	Chloroform and ether.	Oct. 24, abdominal hysterectomy.	Negative.	Negative.	Negative.	Good.	No.	72 hours following operation.	Broncho-pneumonia of both lungs.	Nov. 2: temp., 105; pulse, 130; resp., 40.	9 days.	*Oct. 30, 1895.	No autopsy allowed.	
18. M. J., f.	40	Nov. 14, 1895.	Negative.	Negative.	Poor.	Ether.	Nov. 15, calectomy.	Negative.	Negative.	Negative.	Good.	No.	20 days following operation.	Left lower lobe, posterior.	Nov. 24: temp., 106.8; resp., 40; no pulse noted.	48 hours.	*Nov. 24, 1895.	No autopsy allowed.	
19. G. F., m.	27	April 27, 1896.	Negative.	Negative.	Good.	Ether.	April 28, Alexander's operation, perineorrhaphy.	Negative.	Negative.	Negative.	Good.	Yes.	48 hours following operation.	Right lower lobe, posterior.	April 30: temp., 104; pulse, 118; resp., 40.	5 days.	Cured.		
20. C. K., f.	48	Dec. 8, 1896.	Negative.	Negative.	Good.	Ether.	Dec. 16, calectomy.	Negative.	No record.	No record.	Good.	Yes.	14 days following operation.	Right middle lobe, posterior.	Jan. 1: temp., 104; pulse, 118; resp., 36.	9 days.	Cured.		

TABLE II.

1. S. S., m.	52	July 4, 1891.	Negative.	Negative.	Severe shock, no radial pulse.	Chloroform.	July 11, tracheotomy.	Negative.	Negative.	Good.	No.	No.	12 hours following operation.	Right lung, anterior.	July 16: temp., 104.5; pulse, 140; resp., 36.	6 days.	*July 16, 1891.	No autopsy allowed.	
2. F. S., m.	50	Nov. 18, 1891.	Negative.	Rheumatic.	Severe shock, no pulse, temp., 98° F.	Ether.	Nov. 19, lumbotomy.	Negative.	Negative.	Good.	No.	No.	48 hours following operation.	Dulness, 6th rib right chest, axillary line.	Nov. 26: temp., 106.6; pulse, 165; resp., 36.	7 days.	*Nov. 26, 1891.	24 hours later.	Right lung, seat of extensive broncho-pneumonia.
3. F. M., m.	13	Jan. 1, 1893.	Negative.	Negative.	Good.	Ether.	Jan. 22, thoracotomy, colicotomy.	Negative.	Negative.	Good.	No.	No.	6 hours following operation.	Right lower lobe, posterior.	Jan. 13: temp., 104.5; pulse, 104; resp., 36.	25 days.	Cured.		
4. W. H., m.	42	Oct. 17, 1894.	Tubercular.	For past four weeks noticed sore on right side of tongue.	Good.	Chloroform.	Oct. 18, Kocher's amputation of the tongue.	Negative.	Negative.	Good.	No.	No.	No record.	Right lower lobe, posterior.	Oct. 25: temp., 103; pulse, 120; resp., 36.	8 days.	*Oct. 26, 1894.	27 hours later.	Right and left lung, seat of broncho-pneumonia.
5. O. B., m.	30	Feb. 17, 1895.	Negative.	Negative.	Poor, very anæmic.	Chloroform.	Feb. 17, tracheotomy.	Negative.	Negative.	Poor.	No.	No.	No record.	Both lower lobes.	Feb. 19: temp., 103.8; pulse, 140; resp., 36.	2 days.	*Feb. 19, 1895.	24 hours later.	Congestion of both lower lobes.
6. W. McK., m.	30	Jan. 18, 1895.	Negative.	Negative.	Good.	Ether.	Jan. 18, trephining.	Negative.	Negative.	Good.	No.	No.	48 hours following operation.	Right lower lobe, posterior.	Jan. 19: temp., 102.8; pulse, 140; resp., 36.	10 days.	Cured.		
7. E. S., m.	52	May 8, 1896.	Negative.	Negative.	Good.	Chloroform.	Laryngectomy.	Negative.	Negative.	Good.	No.	No.	No record.	No record.	May 13: temp., 103.5; resp., 68; no pulse recorded.	4 days.	*May 13, 1896.	24 hours later.	A small patch of pneumonia, about 1 inch in diameter, at lower edge of inferior right lobe. Left lobe congested.

* Died.

From this it will be seen that the mortality from pneumonia following the administration of ether was almost 50 per cent. ; that following chloroform, 87.5 per cent. ; and that following chloroform and ether, 100 per cent. The large mortality following chloroform narcosis, I believe, is not due entirely to the anæsthetic, but is due to the fact that the cases having taken chloroform present almost uniform evidence of some malignant lesion of the mouth or upper respiratory tract.

Eighteen cases were males and nine females, varying in age from thirteen years to fifty-five years. It is to be regretted that the time of anæsthesia has not been recorded in the histories, but judging by the operations, the time varied between a few minutes and one and one-half hours.

The right lung was involved in fourteen cases.

The left lung was involved in six cases.

Both lungs were involved in three cases.

No record in four cases.

Pain seems to have been one of the earliest symptoms, and it was generally this which first drew the attention of the attendant to the chest, often a day or two before there was any noticeable elevation of temperature and before the physical signs could be elicited. In 5 cases pneumonia was ushered in by a chill ; of these cases, 3 died and 2 were cured. Of the 9 cases cured, the average duration of the disease was eleven days ; the shortest period for defervescence five days, and the longest, twenty-one days.

In the fatal cases death took place between the second and fourteenth day. The following tables show the duration and the result of the pneumonia :

CLASS I.

No. of Case.	Duration.	Result.	No. of Case.	Duration.	Result.
	Days.			Days.	
1	9	Cured.	11	14	Died.
2	5	Died.	12	5	"
3	7	"	13	8	Cured.
4	10	"	14	3	Died.
5	2	"	15	14	Cured.
6	8	"	16	4	Died.
7	3	"	17	9	"
8	6	"	18	2	"
9	5	Cured.	19	5	Cured.
10	21	"	20	9	"

CLASS II.

No. of Case.	Duration.	Result.	No. of Case.	Duration.	Result.
	Days.			Days.	
1	6	Died.	5	2	Died.
2	7	"	6	10	Cured.
3	25	Cured.	7	4	"
4	8	Died.			

The mortality from pneumonia during the various months was as follows: January, 1; February, 2; March, 2; April, 1; May, 4; June, 1; July, 1; August, 1; September, 0; October, 2; November, 3; December, 0. Thus giving the credit for the highest mortality to May, a comparatively mild month.

In the cases cured, the highest temperature noted was 104° F.; pulse, 140; respiration, 40. The year 1895 shows a record of 9 cases, and in this year pneumonia was very prevalent in New York City, and on the medical division of the hospital many new cases developed in the wards.

Pneumonia following the inhalation of ether or chloroform:

1887.....	No case	1893.....	5 cases
1888.....	No case	1894.....	3 cases
1889.....	No case	1895.....	9 cases
1890.....	1 case	1896.....	3 cases
1891.....	3 cases	1897.....	No case
1892.....	2 cases		

I fully believe that in the next few years the mortality due to complications following operations like pneumonia and nephritis will be steadily decreased, due not so much to an improvement of the anæsthetic or the inhaler, but to the fact that men entering the hospitals for their term of service will have had experience in administering the anæsthetic, thanks to the improved methods of teaching, by instruction in dispensaries and clinics, and thereby many complications will be avoided.

REMARKS ON INDIVIDUAL CASES.

CASE 5. Following an amputation of the thigh, on the *twenty-fifth day* after operation, the patient developed a pneumonia and died. The thigh was examined, but found in a healthy condition.

CASE 24. Prolonged operation due to a complication. Patient left the table in good condition and made rapid progress toward recovery until the seventh day, when he developed a pneumonia and died. No autopsy allowed.

Seven days and twenty-five days seem a rather protracted period for a pneumonia to follow the inhalation of ether or chloroform, but Lienau ("Prakt. Handbuch der gerichtlichen Medicin," vi., Aufl. ii., p. 351) states that pneumonia may come on following the administration of ether and chloroform, and in this view he is upheld by men like Unger and Fraenkel, who have demonstrated this fact by numerous experiments on animals.

CASE 13. An extra-uterine gestation, causing a prolonged operation on account of numerous adhesions; developed twelve hours following operation a bronchitis, two days later a pleurisy with effusion, and three days following a well-marked pneumonia. Recovered.

CASE 16. This patient required a secondary operation, the first operation having been done under ether, in the second chloroform was used. Forty-eight hours following the operation pneumonia developed. Guthrie (3d edition, p. 257), in writing about pneumonias as a cause of death after operations, lays especial stress upon the frequency of pneumonia following secondary operations.

CASE 1. *Compound Fracture of the Leg. Chloroform. Recovery.*—W. H., aged twenty-eight; admitted to Presbyterian Hospital, February 27, 1890, with compound fracture of right tibia and contusions of body. His previous health had been good. Chloroform was administered and fractures dressed. Next day, condition good. Thirty-six hours later pneumonia of right upper lobe developed and patient ran typical pneumonia course, defervescence taking place on the ninth day. He was discharged cured a few weeks later.

CASE 2. *Operation for Inguinal Adenitis. Ether. Death.*—R. M., aged thirty-eight; admitted to Presbyterian Hospital, May 2, 1891. Nine months after gonorrhœa noticed swelling of right groin. With exception of right groin, where there was a marked inguinal adenitis, physical examination negative. Operation, ether, May 5, 1891. Patient placed in prone position and glands dissected out. Recovery from ether was good and condition of patient remained normal until seven days after the operation, when patient had a chill, temperature, 105° F., and he complained of pain in his right chest. Forty-eight hours later signs of pneumonia were detected, and four days later he died. No autopsy allowed.

CASE 3. *Multiple Fractures. Œdema of Glottis. Tracheotomy. Chloroform. Death.*—S. S., male, aged fifty-two; admitted to Presbyterian Hospital, July 4, 1891, in extreme shock. Vomited blood several times. On examina-

tion there was found a compound comminuted fracture, depressed, of both nasal bones, there being complete separation of these bones from the frontal; also a comminuted fracture of both superior maxillæ, crepitation being elicited on grasping teeth of upper jaw; a simple fracture of the right zygomatic arch, a comminuted fracture of left clavicle; a simple comminuted fracture of radius and ulna about two inches above the joint; a compound fracture of left astragalus, a separation of the calcaneo-cuboid articulation on left side, exposing joint surfaces; a compound transverse fracture of the tip of left external malleolus. Treatment for shock was instituted, wounds dressed. On following morning condition was good, temperature, 100° F.; pulse, 90; respiration, 20. July 6, left foot was dressed, parts found in healthy condition. July 8, A.M., marked embarrassment of respiration set in, four to the minute, and all signs indicating that there was some difficulty in the upper respiratory passage. Artificial respiration improved condition. July 9, repeated attacks of dyspnœa supervened and nasal intubation was done, which allowed patient to breathe freely. Wounds were dressed and found in healthy condition. July 11, physical examination negative with exception of throat, which was ecchymotic, swollen, and œdematous. Dyspnœa, which had been more or less distressing since admission, steadily increased, and tracheotomy operation performed under chloroform with good result. Following operation condition much improved. Twelve hours later, temperature, 103.4° F.; pulse, 128; respiration, 44; signs of beginning pneumonia right lung anteriorly, to which patient succumbed, July 16. No autopsy allowed.

CASE 4. *Fracture of Ribs. Crush of Cord. Operation. Ether. Death.*—F. S., male, aged fifty; admitted to Presbyterian Hospital, November 18, 1891 in a state of extreme shock; temperature, 96° F.; no radial pulse could be felt. The patient while at work fell a distance of fifty feet, receiving fracture of the eighth and ninth rib in the post-axillary line, a simple fracture of the tibia and fibula and a fracture of the eleventh dorsal spine. His previous health was good. November 19, laminectomy performed, ether narcosis. Incision was made in median line from ninth dorsal to second lumbar vertebræ, down to and exploring the spinous processes. During the operation patient's condition became extreme, and artificial respiration had to be resorted to. Following the operation condition improved, and next day respirations were regular, temperature, 98.8° F.; pulse, 100. The following morning, November 21, temperature rose to 104° F., respiration increased, and patient complained of slight cough. During morning visit an attempt was made to turn patient on side, but his condition becoming so serious, it was abandoned. July 22, area of well-marked dullness discovered, right chest in axillary line from sixth to ninth ribs. Four days later patient died. Autopsy showed right lung seat of extensive broncho-pneumonia. Crush of cord.

CASE 5. *Compound Fracture of Leg. Lacerated Wound of Knee. Operation. Ether. Death.*—M. K., aged thirty-eight; admitted to Presbyterian Hospital, December 5, 1891. Family history tubercular; mother died of phthisis. Previous history negative. Physical examination negative. On admission

was taken to the operating-room and put under influence of ether, and compound comminuted fracture of tibia and fibula dressed. It was also found that left knee-joint was opened. The wounds were carefully dressed and patient left table in good condition. Forty-eight hours following operation, December 7, temperature was 104° F.; pulse, 132; respiration, 24. Operation, ether narcosis. Amputation of thigh, middle and lower third. The next morning, temperature was 101° F.; pulse, 120, and heart-action much improved; respiration, 28. Condition remained in *statu quo*, limb being frequently examined and found in healthy condition, until January 2, 1892, when patient had a chill, followed by temperature of 102.5° F.; respiration, 30; pulse, 120; and over right apex of lung posteriorly there were found all signs of beginning pneumonia. Patient died January 9. No autopsy allowed.

CASE 6. *Operation for Compound Fracture of Leg. Ether. Death.*—A. M., male, aged thirty-one; admitted to Presbyterian Hospital, March 22, 1892, with compound fracture of tibia and fibula, opening into ankle-joint. Immediate operation—ether. Limb dressed and plaster-splint applied. Patient left table in good condition. The following day condition normal, but next afternoon a severe chill set in, with marked pain in left chest. Physical examination revealed beginning pneumonia. Ten days later death occurred. No autopsy allowed.

CASE 7. *Operation for Mastoiditis. Chloroform. Death.*—M. D., female, aged thirty-seven; admitted to surgical division of Presbyterian Hospital, November 9, 1892. One year ago patient was treated in hospital for pneumonia; for past ten months she enjoyed good health. Two months ago noticed a slight discharge from ear, which ceased during past week and aural pain set in. Patient was admitted November 8 to medical division and transferred the next day, when operation, chloroform narcosis, was performed. The mastoid cells were opened, but no pus was found. The same evening, temperature was 102° F.; six hours later, 105° F.; pulse, 136; respiration, 38. During the next day patient complained of severe pain in various parts of upper extremity, and vomited a greenish fluid in large quantities. Toward evening temperature fell to 96° F.; pulse, 91; respiration, 24; only to rise to 101.5° F. one hour later. No further record with exception of death, which occurred on November 11. Autopsy, twenty-four hours later, showed upper half of left lower lobe hepatized, red, and gray. Rest of lung, moderate congestion and œdema. Right lung, a few adhesions. Chronic nephritis.

CASE 8. *Pistol-shot Wound of Chest. Operation. Ether. Recovery.*—F. H., male, aged thirteen; admitted to Presbyterian Hospital, January 1, 1893, with pistol-shot wound of chest. The ball (calibre, 32) had entered fifth intercostal space of right side, about one inch to right of costo-chondral articulation. On admission, temperature, 102° F.; pulse, 108; respiration, 24; a few hours later temperature rose to 104.5° F.; pulse, 124; respiration 56. Immediate operation, ether, thoracotomy and cœliotomy performed, sixth costal cartilage being removed. No injuries to lung or abdominal viscera found. Patient made a good recovery from ether, and temperature following operation dropped to 101° F. Six hours later temperature was 104.5° F.; pulse, 120; respiration, 48, and

bronchial breathing and voice detected in right lower lobe. Patient made an uneventful recovery.

CASE 9. *Operation for Cancer of Sacrum. Ether. Death.*—T. O'W., male, aged thirty-eight; admitted to Presbyterian Hospital, February 27, 1893, with carcinoma of sacrum. Operation, ether narcosis, March 7. No record of position. An incision two inches long, from base to tip of sacrum, was made. The disease, however, was found to be so extensive that only curettage was performed, most of sacrum being removed. Patient left table in good condition. For the following two days condition remained good, wound clean and healthy looking. The next morning pneumonia was discovered. Eight days later patient died. No autopsy allowed.

CASE 10. *Perineorrhaphy. Ether. Death.*—A. B., female, aged forty; admitted to Presbyterian Hospital, March 17, 1893. Her general condition was excellent. Operation, March 24, ether narcosis, Bischoff's colpo-perineoplastic operation being done. Immediately after operation temperature began to rise and painful cough set in. No record when pneumonia developed, but patient died three days later. Autopsy showed lobes of left lung congested and œdematous.

CASE 11. *Operation. Nephrotomy. Chloroform and Ether. Death.*—M. H., male; aged twenty-six, admitted to surgical division of Presbyterian Hospital, June 1, 1893. May 14, 1893, patient was admitted to medical division with pneumonia involving right *lower* lobe. Defervescence followed five days later, and for several days temperature was normal. Eight days later he had a chill, temperature, 103.5° F.; dull pain and a sense of increased resistance in right iliac fossa. Symptoms not improving, patient was transferred to surgical division, June 3, and cœliotomy, chloroform narcosis, performed. During operation ether was substituted for chloroform with good result, pulse of patient being much improved. After exploratory operation, which proved negative, patient was turned on face and chest and nephrotomy done, but with same result. Patient left the table in poor condition. During the night he complained of great pain in his chest, his breathing was rapid and shallow. Next morning respiration irregular, 46; pulse full, 124; temperature, 104.5° F. In upper right lobe, dulness detected. Death took place six days later. Autopsy showed right kidney full of infarcts running from pelvis outward. Appendix normal. No abscess in liver or about diaphragm. Lobar pneumonia of right upper lobe.

CASE 12. *Operation for Penetrating Stab-wound of Abdomen. Ether. Recovery.*—D. M., male, aged twenty-one; admitted to the Presbyterian Hospital, October 20, 1893, suffering from a penetrating stab-wound of the abdomen. On admission temperature was 98.6° F.; pulse, 100; respiration, 28. Operation, ether, cœliotomy. Abdominal viscera found not injured. Patient left table in good condition. Next morning upper left lobe in axillary line showed signs of beginning consolidation. After five days defervescence occurred; two weeks later patient left hospital.

CASE 13. *Operation for Extra-uterine Gestation. Ether. Recovery.*—M. G., female, aged twenty-seven; admitted to the Presbyterian Hospital, January 1, 1894. Family and previous history negative until present trouble. Jan-

uary 3, cœliotomy, ether, for extra-uterine gestation, patient being placed in Trendelenburg's position. To the right of the uterus there was a mass the size of an orange, which was firmly adherent to the uterus and somewhat to small intestines, and was only removed with the greatest difficulty. The condition of the patient was good when she left the operating-pavilion. The next morning a bronchitis was diagnosed, and the following day the temperature rose to 103° F., and a very distressing cough set in. Two days later pleurisy with effusion was discovered, and on the fifth day after the operation a pneumonia of the right lung developed. Patient some weeks later left the hospital cured.

CASE 14. *Operation for Cellulitis of Hand. Ether. Death.*—J. B., male, aged twenty-five; admitted to the Presbyterian Hospital, May 9, 1894, with history of cellulitis of hand following injury to finger. Physical examination revealed large, fluctuant mass in right axilla, but otherwise negative. Operation, May 9, ether, incision and drainage of abscess. Next day condition was slightly improved, and continued so until May 15, when patient complained of severe pain in left chest. The following morning left lower lobe showed signs of consolidation. His condition steadily grew worse until May 21, when patient died. No autopsy allowed.

CASE 15. *Operation for Cancer of Tongue. Chloroform. Death.*—W. H., male, aged forty-two; admitted to Presbyterian Hospital, October 17, 1894, with epithelioma of tongue. General condition good. Kocher's amputation of the tongue done under chloroform anæsthesia, October 18. Patient did badly following operation, and pneumonia developed, but no record of exact date. October 26th, died. Autopsy showed congestion of both lungs and broncho-pneumonia.

CASE 16. *Operation. Compound Fracture of Leg. Ether. Death.*—J. B., male, aged twenty-six; admitted to the Presbyterian Hospital, January 28, 1895, with compound comminuted fracture of leg, with extensive laceration of soft parts extending up to knee. Operation, ether, the same day, and the attempt made to save the limb. A plaster-splint was applied, and the patient left the table in good condition. Following the operation there was persistent oozing of blood from under the splint, necessitating various means of controlling hemorrhage, but all of no avail. It was finally deemed necessary to do a second operation, which was done under chloroform, January 30, consisting in amputation just below the knee. The condition of the patient for the following forty-eight hours remained good. Then a chill set in, with rise of temperature, delirium, etc. Limb was dressed, but found in healthy condition. Four days later pneumonia of left lung was diagnosed and patient died February 5. No autopsy allowed.

CASE 17. *Tracheotomy. Chloroform. Death.*—O. B., male, aged thirty-two; admitted to the Presbyterian Hospital, February 17, 1895, with history of attempted suicide. Patient had an incised wound of neck, the epiglottis being severed through thyro-hyoid membrane. Immediate tracheotomy was performed, chloroform narcosis, and dyspnœa of patient relieved. Death occurred two days later. Autopsy showed congestion of both lower lobes.

CASE 18. *Operation. Trephining. Ether. Recovery.*—W. McK., male

aged thirty; admitted to Presbyterian Hospital with a compound fracture of skull, and a fracture of the two lower ribs in the left axillary line. Immediate operation, ether, removal of spiculæ of bones and clot from brain. The following day his condition was good. Twenty-four hours later pneumonia of right lower lobe diagnosed; five days later defervescence set in. Two weeks later patient discharged cured.

CASE 19. *Operation. External Urethrotomy. Ether. Recovery.*—W. S., male, aged thirty-three; admitted to Presbyterian Hospital, March 30, 1895. Present illness began one year ago with marked pain at neck of bladder after voiding urine. Now passes urine every hour, day and night, occasionally blood, and cannot sleep on account of pain. Urine, 1018; albumin, four per cent.; blood and leucocytes. Operation, ether, March 30, external urethrotomy performed. Post-urethra found contracted and prostate roughened. Good recovery from ether. Four days later, dulness and signs of marked consolidation in lower right lobe. Eight days later lung was resolving rapidly. May 2, urine voided naturally, and patient was discharged cured.

CASE 20. *Operation. Bullet-wound of Head. Chloroform. Death.*—A. B., female, aged twenty-four; admitted to Presbyterian Hospital, March 14, 1895, with bullet-wound (22 calibre) of head. On admission, patient was in a semi-comatose condition; temperature, 101° F.; pulse, 70; respiration, 26. Operation, chloroform, wound probed, but no depression found. Next morning temperature was 99° F.; pulse, 70; respiration, 24; no paralysis. In the afternoon temperature rose to 102° F., and fluctuated between 100° F. and 102° F. until May 17, when it reached 103° F., in the evening 106° F., and patient died. Autopsy showed left lung congested and unaërated, right lung a broncho-pneumonia.

CASE 21. *Operation for Appendicitis. Ether. Recovery.*—L. J., aged thirty-six, female; admitted to Presbyterian Hospital, July 15, 1895. Immediate operation, ether, for appendicitis. Large iliac abscess opened, well shut off from general peritoneal cavity by adhesions. Appendix not found, cavity cleansed, and wound packed with iodoform gauze. There was a marked improvement following the operation for the next two weeks, when patient developed a pneumonia of both lower lobes posteriorly, from which she recovered and left hospital six weeks later.

CASE 22. *Appendicectomy. Ether. Death.*—R. M., male, aged fifteen; admitted to Presbyterian Hospital, September 14, 1895, with appendicitis and temperature 103.8° F. Physical examination of chest negative. Immediate operation, ether, appendix, which was well encapsulated, successfully removed, no perforation found. Following operation, temperature fell to 102° F., and condition steadily improved until next morning, when patient had a chill, and a pneumonia of the right lung was discovered. Three days later patient died. No autopsy allowed.

CASE 23. *Operation. Hysterectomy. Chloroform and Ether. Death.*—A. A., female, aged fifty; admitted to the Presbyterian Hospital, October 23, 1895, with a fibroid tumor of the uterus. Operation, chloroform and ether, October 24, abdominal hysterectomy performed. A large tumor found, bound down by numerous adhesions; both ovaries and tubes removed. Next day con-

dition of patient good and remained so until three days later, when she developed a pneumonia and died on the sixth day. No autopsy allowed.

CASE 24. *Operation for Intestinal Obstruction. Ether. Death.*—M. J., female, aged forty; admitted to the Presbyterian Hospital, November 12, 1895. January, 1895, abdominal hysterectomy had been successfully performed. Present illness began three days after late dinner, when patient was suddenly seized with severe abdominal pain. Since that time she has vomited all nourishment, and in right iliac fossa there is great tenderness on pressure. Bowels constipated, temperature, 100.6° F.; pulse, 96; respiration, 22. Urine negative. Operation, cœliotomy, November 12, ether narcosis. A piece of strangulated intestine was found being held in position by old adhesions. Eighteen inches of intestine was resected, and end-to-end anastomosis performed by means of Murphy's button. Patient improved after operation, and was on regular diet, when pneumonia developed, November 22, resulting two days later in death. No autopsy allowed.

CASE 25. *Operation. Laryngectomy. Chloroform. Death.*—E. S., male, aged fifty-two; admitted to Presbyterian Hospital with sarcoma of larynx. Operation, May 9, laryngectomy, chloroform narcosis, performed in usual manner. No record of time when pneumonia developed. Death followed four days after operation. Autopsy showed a small patch of pneumonia about one inch in diameter at lower edge of inferior right lobe. Left lobe congested.

CASE 26. *Perineorrhaphy. Alexander's Operation. Ether. Recovery.*—G. B., female, aged twenty-seven; admitted to Presbyterian Hospital, April 27, 1896, for retroversion of uterus and lacerated perineum. Family and previous history negative. Operation, April 28, ether narcosis. The patient left the table in good condition and made a splendid recovery from the anæsthetic. The next morning the temperature was normal. The following morning the patient had a chill, followed by a rise of temperature, and complained of severe pain in the chest. A pneumonia was diagnosed twenty-four hours later. Patient cured.

CASE 27. *Operation. Abdominal Hysterectomy. Ether. Recovery.*—C. K., female, aged forty-eight; admitted to Presbyterian Hospital, December 8, 1896, with large fibroid tumor of uterus. Operation, abdominal hysterectomy, December 16. Patient was placed in Trendelenburg's position and a median incision was made. A large fibroid tumor was removed after considerable difficulty, numerous adhesions being present. Patient made a good recovery from ether and her general condition remained good until January 1, 1897, when a pneumonia of the right middle lobe developed, which ran a typical course. After five days dulness spread over the entire chest behind; and the latter being aspirated, eight and one-half ounces of serum were obtained. No tubercle bacilli found in the fluid. January 28 patient was discharged cured.

XXI.

A REPORT OF TWO CASES OF INTESTINAL RESECTION.

BY LEONARD C. SANFORD, M.D.

CASE I. (Service of Dr. Briddon.) Mrs. S., aged thirty-eight ; married ; washerwoman.

Previous History.—Patient has had a reducible femoral hernia for the past five years. For the last two years a small portion of the sac has been adherent to the subcutaneous tissues. She has been able, however, to continue her occupation with but slight inconvenience.

Present History.—For the past forty-eight hours all the symptoms of strangulation have been present.

On admission, January 26, 1896, temperature, 103° F. ; pulse, 120 ; respiration, 26.

Physical Examination.—There is a small tumor the size of an egg protruding from the right femoral ring. The abdomen is somewhat tense and distended.

Operation by the house-surgeon, Dr. L. C. Sanford. The sac was exposed and opened through a vertical incision over the femoral ring. It contained a small amount of turbid serum. Protruding from the ring was a knuckle of strangulated small intestine the size of an egg. The gut was deep mahogany in color with two areas of sloughing wall, each the size of a dime, extending entirely through the muscular coat, caused evidently by constriction at the outer edge of Gimbernat's ligament. An herniotome passed upward and inward, divided Poupart's ligament before the stricture was relieved. With the object of removing the damaged gut, six inches of small intestine were drawn through the incision. The peritoneal cavity was protected with pads and sponges. The intestinal contents having been removed as far as possible by pressure, the gangrenous area with four inches of adjacent gut was included between two intestinal clamps, the contents of the portion about to be removed being kept intact by two additional clamps. Four inches of small

intestine with a wedge-shaped piece of mesentery were resected. An end-to-end anastomosis was effected by suturing the opposite surfaces of mucous membrane with continuous fine silk. The muscular wall and serous coat were sutured over this by a double row of silk Lembert stitches. The mesentery was closed with catgut. The field of operation was washed almost continuously with hot salt solution and the intestine reduced. A catgut suture closed completely the peritoneal cavity. The cut edges of Poupart's ligament were united by means of fine silk. By suturing the under surface of Poupart's ligament to the pectineus muscle, that portion of the femoral ring previously occupied by the hernia was closed. The skin incision was drained with rubber tissue.

With the exception of a temperature of 101° F. during the first twenty-four hours, and of 100° F. for the three days following the operation, there were no constitutional symptoms.

In the first twenty-four hours after operation small pieces of cracked ice were allowed. At the end of forty-eight hours broth and beef-tea were administered in careful quantity and at frequent intervals. Soft food was given on the fifth day, and solid diet two days later. The bowels moved on the fourth day after two grains of calomel had been taken in divided doses. The wound healed by first intention. Uneventful recovery followed and the patient was discharged February 19, twenty-nine days after admission. Six months later she reported having enjoyed the best of health. The scar was perfectly firm.

CASE II. (Service of Dr. McCosh.) Mrs. N., aged forty; married; servant.

Previous Personal History.—A reducible femoral hernia causing no inconvenience has existed for ten years.

Present Illness.—Symptoms of strangulation for the past two days.

On admission, January 28, 1896, temperature, 103.5° F.; pulse, 118; respiration, 28.

Physical Examination.—There is an irreducible femoral hernia the size of a hen's egg on the right side. Patient is about three months pregnant.

Operation by the house-surgeon, Dr. L. C. Sanford. A vertical incision three inches in length was made over the hernia. Sac

on being isolated was found to emerge from the femoral ring. It contained a small amount of turbid fluid. A knuckle of strangulated small intestine appeared. It was ebony in color, lustreless, and a decided odor was apparent. The strangulation was relieved as in the previous case by dividing Poupart's ligament, the incision being carried upward and inward. A loop of small intestine was drawn into the wound and the peritoneal cavity protected as before. Intestinal clamps were applied and the gangrenous area removed with four inches of its mesenteric attachment. A small-sized Murphy's button was employed to effect the anastomosis, and the mesentery sutured with catgut. After washing the field of operation with large quantities of hot salt solution, the intestine was replaced and the peritoneal cavity closed completely, the wound being sutured precisely as in Case 1.

Patient aborted on the following day and suffered from slight sepsis for two weeks afterward, when her temperature subsided and the uterus regained its normal size.

For the first two days she was nourished as in the former case. Solid food was withheld until temperature subsided on the fourteenth day.

The bowels moved on the fourth day after two grains of calomel had been given in divided doses, and remained regular afterward.

The Murphy button was unfortunately lost.

The wound healed at once, and patient was discharged five weeks after the operation. Six months afterward she was seen. Her condition during this time had been satisfactory, and the scar examined then was firm.

It will be observed that in each of these cases a peritoneum exposed to sources of infection was closed completely. In doing this the following points were taken into consideration :

First, the possibility of protecting the general peritoneal cavity in the ordinary way and of removing, by mechanical means, the local infection inevitably resulting from a previously existing gangrenous and perforated gut, as well as from a division of intestine during the operation. *Second*, the desirability of securing a strong abdominal wall.

The writer, however, does not offer the good results in the two cases just quoted as an excuse for a similar procedure, even under similar circumstances.

XXII.

A CONTRIBUTION TO THE STUDY OF MALIGNANT ENDOCARDITIS CAUSED BY THE MICROCOCCUS LANCEOLATUS.

BY WALTER B. JAMES, M.D.

SOON after the discovery of the micrococcus lanceolatus, the existence of this micro-organism in the lesions of malignant endocarditis was definitely proved by Weichselbaum¹ and by Netter. But it was generally assumed that in these cases the lesion of the heart-valves was secondary to a pneumonic process in the lungs, and that the endocarditis was a complication of a foregoing pneumonia.

It is the object of the present paper to call attention to two cases of endocarditis pneumonica that have recently been under observation in the Presbyterian Hospital, in which no history of any antecedent inflammation in the lungs could be obtained, and in which it seemed fair to regard the disease as the result of an accidental inoculation of the pneumococcus upon heart-valves already the seat of a chronic endocarditis of rheumatic origin.

It is also proposed to briefly review the literature of the disease, especially from a clinical point of view, and to examine the rules that have been given for the differential clinical diagnosis between pneumonic and septic malignant endocarditis, in order to determine, if possible, whether the trustworthiness of these rules is borne out by what was observed in the two cases under consideration.

The bacteriological diagnosis in the accompanying cases is based upon the results of the examination of cultures obtained from the blood of the patients, *intra vitam*, by a method elsewhere fully described in this report.

In one of the cases the diagnosis was verified also by bacteriological examination of the various organs carried out at the autopsy by cultures.

In the second case, unfortunately the patient insisted upon leaving the hospital, though after remaining there a considerable length of time, and it was learned that she succumbed to the disease after the lapse of several months. While she was in the hospital the blood was examined for bacteria, and the presence in it of the micrococcus lanceolatus was proved beyond question by culture experiments carried out on two separate occasions.

Given a case of malignant endocarditis, it is assumed that it is fair to regard as the *materies morbi* a pathogenic bacterium that is repeatedly and uniformly cultivated from blood drawn direct from a vein by a method which reduces the chances of contamination to a minimum.*

This micro-organism, the micrococcus lanceolatus, has been much studied and often and variously named, and it is unfortunate that the most commonly used of these names, diplococcus pneumoniae, emphasizes too strongly its association with pneumonia. It is true that as far as our present knowledge goes, this is its most important relation to human pathology, but as our experience with it becomes more extensive, we are constantly brought in contact with evidences of its possibilities for harm entirely apart from its power to produce inflammation of the lungs. Indeed, it seems necessary now to admit it into the class of pyogenic organisms, so often is it found as the sole cause of suppurative processes, and so similar are its results, both pathological and clinical, to those brought about by the staphylococcus and streptococcus pyogenes. For instance, Boulay met with a case of general peritonitis and meningitis, caused by the diplococcus lanceolatus, and in which there was no antecedent pneumonia. Many cases have been described in which this organism has set up inflammation of various parts of the body, such as the middle ear, the meninges, the synovial membranes of the joints, and where it has been impossible to obtain a history of any inflammation of the lungs, either associated with the local lesion or preceding it.

Lesage and Pinaud studied an obscure case of severe cachexia, becoming more and more marked, and going on to a fatal issue, after lasting three months. Its course was without fever. At the autopsy there were found pleurisy, pericarditis, peritonitis, and

* See page 44 of this report, James and Tuttle.

ulcerative endocarditis, and in all the various lesions the micrococcus lanceolatus was found in abundance.

Many other cases might be cited to prove that this micro-organism is capable of setting up severe and even fatal inflammation in other organs than the lungs.

It therefore seems best, with Weichselbaum, to use the term micrococcus lanceolatus, which sufficiently accurately describes its microscopical appearance without in any way defining or limiting its pathological capabilities, and which at the same time already has a fairly wide usage.

The term endocarditis pneumonica was first used by Weichselbaum, and is open to the same and even greater objections. As long as the disease was supposed to occur only as a complication of acute lobar pneumonia, it answered the purpose; but with a growing conviction that it occurs fairly often or even in a majority of cases without association with pneumonia, the above title becomes obviously an improper one. Nevertheless, in the present paper it is retained, merely because no other is at hand which promises to satisfy permanently all the requirements of a satisfactory scientific title, and it seems best not to multiply terms if it can be avoided.

Among the first to point out the possibility of a general infection of the organism by the bacterium which is the cause of acute lobar pneumonia was Meyer,³ who in 1887 demonstrated the presence of the micrococcus lanceolatus in the acutely inflamed heart-valves found in a case of pneumonia that had also been complicated with acute meningitis.

In the following year Weichselbaum¹ described 7 cases of acute endocarditis, caused by the same bacterium. Of these, as far as their gross pathology is concerned, 6 were of the ulcerative variety, while 1 showed vegetations without ulceration.

In 5 of the cases the heart-lesion followed upon either pneumonia or meningitis, while in 2 it occurred without any cause that could be discovered.

Weichselbaum took a pure culture obtained from these diseased valves and injected it into the veins of rabbits, having previously produced artificially a lesion of the aortic valves through the carotids. He was able to bring about an acute endocarditis affecting the above valves and exhibiting in its lesions the same species of bacteria that had been used for the injections.

The conclusions reached by him are as follows : *First*. That the micrococcus lanceolatus is one of the commonest and most dangerous of all the pathogenic micro-organisms. *Second*. That in its early stages the inflammation caused by it is of a serous type, later fibrinous, and finally with the production of pus. He believes that in point of malignancy it stands between the streptococcus pyogenes and the staphylococcus pyogenes, but is nearer the former than the latter.

In the inflammatory exudate of pericarditis, as well as of endocarditis following pneumonia, the micro-organism in question has been repeatedly found.

Banti⁴ observed two cases, of which one showed the pneumococcus alone, the other showed this organism together with the staphylococcus pyogenes albus.

In each of the two cases whose histories immediately follow, the clinical picture presented was that of a typical malignant endocarditis, belonging to that type of the disease in which the duration of the malady is considerable. They were cases whose clinical diagnosis offered few or no difficulties.

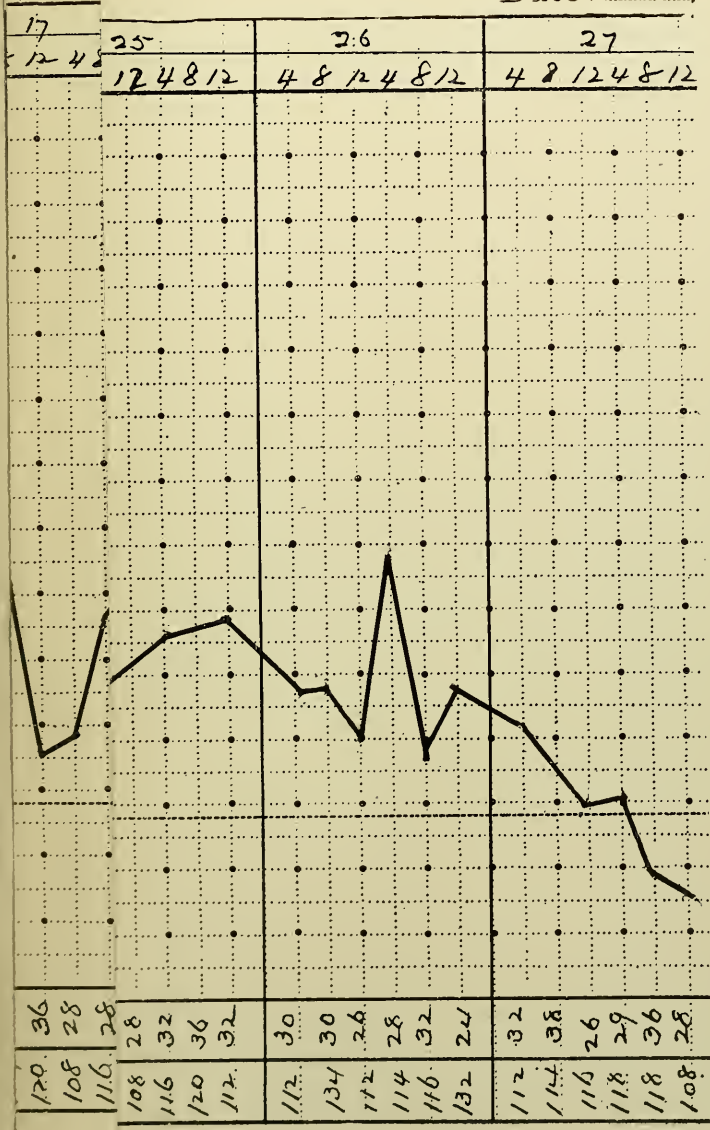
Wilhelmina B., aged nineteen ; nationality, German ; admitted, May 1, 1897 ; died, May 28, 1897.

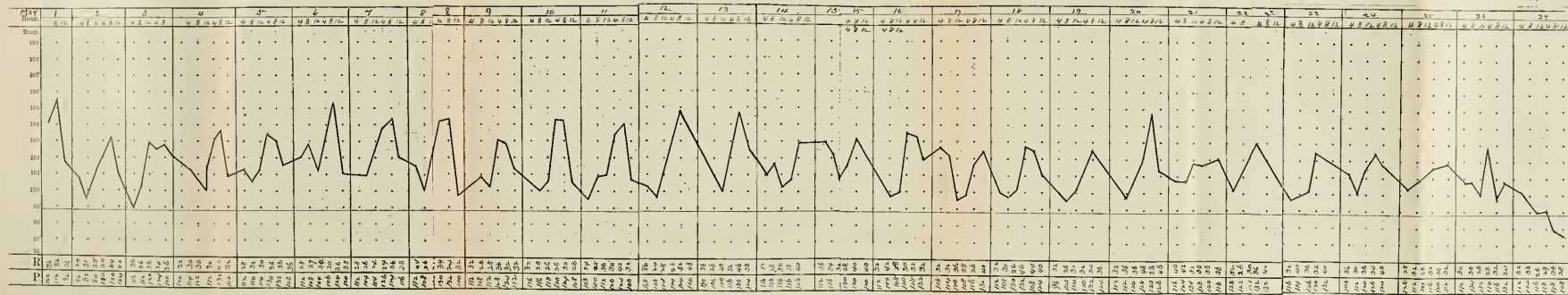
Diagnosis.—Malignant endocarditis ; complications, infarctions in kidneys, liver, and spleen.

Family History.—Negative.

Personal History.—She has generally been in good health ; she has been married about one year and has no children. No miscarriages. She has not menstruated since January 23, although she does not think she is pregnant. There is no history of pneumonia, nor of any previous pulmonary trouble.

Her present illness began January 13, 1897, with a mild attack of inflammatory rheumatism in the hands and feet ; this kept up on and off until a few weeks ago. She did not go to bed with the rheumatism. For the past few weeks she has been troubled with dyspnoea and palpitation and has become very anæmic. She has been confined to bed for one month on account of these symptoms. Two days before admission she had sudden loss of power in right arm and leg, with complete aphasia ; this condition has cleared up somewhat on admission. She was told by a physician two months ago that she had organic heart-trouble.





Physical Examination.—May 2. The patient is rather poorly nourished and markedly anæmic. The tongue is moist and heavily coated; the lips are dry; the pupils are equal and react normally. There is some fulness of the left side of the neck, just below the ear; there is marked sensitiveness to pressure over this area. There are enlarged lymph-nodes on the left side of the neck posterior to the sterno-mastoid muscle. There is some congestion of tonsils, fauces, and posterior pharyngeal wall. *Heart.* The apex impulse is in the fifth intercostal space, three and one-half inches from midsternum; its action is rather irregular; it occasionally intermits; there is a very loud, harsh systolic murmur over the mitral area at the apex transmitted around into axilla, and heard all over the back; there is a systolic murmur at the base, loudest over the pulmonary area; there is marked accentuation of pulmonic second sound; in the second left interspace a distinct thrill can be felt corresponding to the end of diastole. *Pulse*, soft, rather small. *Lungs.* Thorough examination is impossible. The respiratory murmur is very feeble. *Liver.* Upper border at sixth rib; percussion-dulness extends to a point about an inch below the free margin of the ribs in mid-clavicular line; its edge is indistinctly felt. *Spleen*, percusses large; edge is not felt. *Abdomen*, held rigid; seems to be generally hypersensitive, especially over region of liver. *Extremities.* There is some impairment of power in the right upper and lower extremity. The reflexes seem about normal; she cries out loudly on the slightest irritation applied to extremities.

May 3. There is slight irregularity of the pupils, the right one being larger than the left. The impairment of power in right arm is much less marked. She is still hypersensitive over right leg, and, to a certain extent, over the left.

Examination of Urine.—Amount in twenty-four hours, seventeen and one-half ounces. Color, amber; turbid. Specific gravity, 1012. Reaction acid; albumin, six per cent.; no sugar. The sediment contains uric-acid crystals, phosphates, and leucocytes.

May 7. Physical examination is about the same as on May 2. The lower edge of the liver is rather more tender on palpation. There is no œdema. The loss of power in right arm and leg is still evident. There is one small ecchymosis in the middle of the inner surface of the right upper arm. The pulse is rapid, quick, and soft.

Examination of Blood.—Red cells, 2,546,000 in cubic millime-

tre ; white cells, 14,000 in cubic millimetre ; hemoglobin, forty per cent. (Fleischl). A specimen of blood was drawn from the median basilic vein and distributed among seven Loeffler blood-serum tubes. They showed a growth of the micrococcus lanceolatus.

Urine.—Amount in twenty-four hours, twenty-one and one-half ounces. Color, yellow ; clear. Specific gravity, 1012. Reaction acid ; a slight trace of albumin ; no sugar. There is an amorphous sediment containing a large amount of urates, a few leucocytes, and a few red blood-cells.

May 12. The irregularity of the pupils is rather more marked ; hypersensitiveness of right foot and leg is very marked ; paralysis of right arm and leg seems rather less.

May 13. Her condition has grown worse ; general appearance is not so good ; she takes food with difficulty.

Blood Examination.—Red cells, 2,150,000 ; white cells, 7,000.

Urine in twenty-four hours, fourteen ounces. She has two loose stools daily.

May 14. She is very drowsy and has difficulty in speaking.

Blood Examination.—Hemoglobin, forty-three per cent.

May 25. The condition has remained about the same ; at times the movements from the bowels are involuntary.

Blood Examination.—Red cells, 1,806,000 ; white cells, 10,000 ; hemoglobin, forty-three per cent.

May 28. The patient died, having grown gradually weaker, the pulse becoming more and more rapid and feeble.

Autopsy.—May 28. Thirteen hours after death. *Pericardium*, normal. *Heart*. Weight, fourteen ounces. The mitral valves are covered with a thick fringe of vegetations which extend upward on the anterior surface of the auricle, forming a thick patch, also downward on the surface of the ventricle, as minute scattered tubercles. The surface of the vegetations is rough and ragged, but apparently not ulcerated. The heart-muscle is mottled with pale areas. The pleura is normal. *Left Lung*. Weight, twenty-two ounces. There is marked œdema ; the lung-tissue is rather firm and tough. *Right Lung*. Weight, twenty-six and one-half ounces. In other respects its condition is the same as that of the left. *Peritoneum*, normal. *Gall-bladder* is full of green bile. *Liver*. Weight, sixty-two ounces. Its consistence is firm, its surface smooth. Section shows congestion. *Spleen*. Weight, fourteen ounces. Consistence, rather soft ;

surface scarred deeply and mottled with white infarctions. Section shows numerous white infarctions. *Pancreas*, normal. *Left Kidney*. Weight, six and one-half ounces; adrenal, normal; ureter, normal; capsule, free; consistence, firm. Surface smooth and mottled with minute red spots, which have the appearance of septic infarctions. On section the cortex is somewhat thickened, rather pale, and its markings indistinct. *Right Kidney*. Weight, six and one-half ounces. Condition same as that of left. *Stomach*. Mucous membrane very pale; in other respects it appears normal. *Uterus* and *Ovaries*, normal.

Microscopical Examination.—Kidney. The connective tissue is much increased. Most of the malpighian tufts have been transformed into fibrous tissue. There is an abundant infiltration of leucocytes both diffuse and in more dense foci, and they are found also in some of the tubules. Some of the tubules are normal, while others are distended with blood, and others contain leucocytes. Some are filled with granular material, some with hyaline material. The tubular epithelium in places is normal, in other places is degenerated. The malpighian pyramids are congested. *Spleen*. The spleen in parts contains more fibrous tissue than is normal, and in parts shows an abundance of polynuclear leucocytes. *Heart-valves*. Sections through the vegetations and the subjacent tissues show superficially masses of fibrin and leucocytes, and in places a fringed border deeply stained with hematoxylin. This last is found to consist of a mass of crowded cocci, very minute, some of them apparently slightly longer than broad, and showing some tendency to the formation of short chains. At the free surface chains of cocci are arranged perpendicularly to the edge. There is a moderate infiltration of leucocytes into the connective tissue beneath, and a very little infiltration of the muscle. A few masses of cocci resembling those seen at the surface are found filling lymph-spaces in the muscles, but not immediately surrounded by inflammatory changes.

Cultures were made from the spleen, liver, and kidneys. Those from the spleen showed two colonies of the micrococcus lanceolatus. Those from the liver showed a great many colonies of the same.

These cocci preserved their characteristics when planted on different media. They were always diplococci of characteristic form and never formed chains, even in bouillon. If not transplanted every two or three days, they quickly died.

From the kidney-culture was obtained one yellow colony of very large cocci which were not identified, and which was apparently an accidental contamination. No other bacteria were found in any of the organs.

In the accompanying plate the left ventricle has been laid open, showing the extensive vegetations on the mitral valves, their appearance and situation.

Margaret S. ; book-keeper ; aged twenty-two ; American ; admitted, July 10, 1897 ; discharged, August 18, 1897.

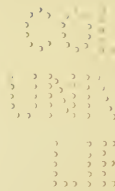
Diagnosis.—Endocarditis pneumonica. Result, improved. Complications, retinal hemorrhage.

Family History.—Negative.

Personal History.—She had pertussis and “scarlet rash” as a child ; there is no history of pulmonary trouble, except a slight attack of bronchitis. From the age of eight to fifteen she had very frequent nose-bleeds in summer ; her menses have been monthly, but slightly irregular ; otherwise health has been good. For the last year she has had to work very hard and has been somewhat run down and anæmic, for which she has been treated the last four months. In May (about the first of the month) she had a severe epistaxis in place of her menstruation and was in bed three days following ; she was very pale but began to work again. About June 1 she had rheumatism in ankles and knees for a week, but was not kept from working ; in a few days had a blurring of vision in the left eye and was told she had a hemorrhage in the retina, and the oculist told her she must stop work, which she did. She has had only one slight menstrual flow since May 1. Her bowels have always been regular. There is no alcoholic habit. At the age of ten she had pain in the knees for three days after catching cold. No other history of rheumatism. At the age of fifteen she was told she had a heart-murmur. She has never suffered from dyspnœa.

Present Illness.—On July 2 she fell and strained her left side. Since July 3 she has had pain in the side, between last rib and the crest of the ilium, severe enough to confine her to bed ; otherwise she has been feeling well. Four days ago her physician put her on fluid diet. She has had no diarrhœa, sleeplessness, vomiting, or nose-bleed ; her appetite has been good ; no cough, no headache, except a slight one yesterday.

Physical Examination.—July 11. She is well-nourished ; not



anæmic; tongue moist and coated with whitish fur, rather pale; cheeks rather flushed, no enlargement of superficial glands; skin moist. *Heart*. Apex impulse is in fifth space, three and one-half inches to left of middle line. There is a systolic thrill felt over apex; action regular, good force. There is a loud and rather harsh systolic murmur heard over the pulmonary area. The area of cardiac dulness is not increased. *Pulse*, soft, regular, fair quality. *Lungs*. In lower left axillary region there are numerous faint crepitant râles. *Liver*. The upper border of dulness is at the fifth rib. Flatness extends to the free margin of the ribs. The edge of liver cannot be felt. *Spleen*, percusses below the margin of ribs, but the edge cannot be felt. *Abdomen*, held a little rigid; not distended; tympany not increased; slight tenderness on left side, more marked on admission. Extremities, very slight œdema of the legs. *Surface*. There are one or two pinkish spots on lower part of abdomen, not typical. No reaction to Erlich's test for typhoid fever.

July 12. Spleen indefinitely felt about two fingers' breadth below costal arch; left side less painful.

July 14. There is a pre-systolic murmur over mitral area; no longer any pain.

July 15. Spleen felt two fingers' breadth below costal margin; no reaction to Widal's test for typhoid fever.

July 20. No reaction to Widal's test.

July 22. A specimen of blood taken from a vein of the arm is sown in two tubes; one tube shows one colony, the other, two. The growth is grayish-white, the colonies small. On examination it proves to be the micrococcus lanceolatus.

July 27. *Heart*. Apex three and one-quarter inches to left of middle line in fifth space; action regular; murmur same as original note. The mitral systolic murmur can be heard over both chests posteriorly. *Lungs*. Left, posteriorly from a point three and one-quarter inches below angle of scapula to base there is marked dulness. In the axillary region there is dulness from a line three inches below nipple to the base. Diminished voice and breathing. *Spleen*, edge felt one and one-half inches below costal margin. *Surface*, negative, no petechiæ.

July 28. Blood shows no reaction to Widal's test.

July 29. Another culture from blood taken from the arm contains many colonies; all prove to be culture of micrococcus lanceolatus.

July 31. General condition very good. Ophthalmoscopic examination shows left retina just above the disc has a small triangular area which is lighter in color than the surrounding part, apparently the remains of an old hemorrhage.

August 1. No petechial spots found.

August 4. General condition very good. Blood-leucocytes 10,000 in cubic millimetre.

August 5. Blood examined for plasmodium malarix and none found.

August 6. Blood-leucocytes, 10,000.

August 7. The blood shows no reaction to Widal's test.

August 9. She says that late yesterday afternoon, suddenly, without any pain, things began to look blurred, with a reddish hue, similar to condition that existed in left eye when that was affected. She has been using right eye almost exclusively of late. Yesterday morning her doctor came in and agitated her very much, her excitement ending in weeping.

August 10. On left forearm and on front of chest are a few small petechial spots.

August 13. The petechix on the left arm have faded somewhat ; there is a new one along left costal arch.

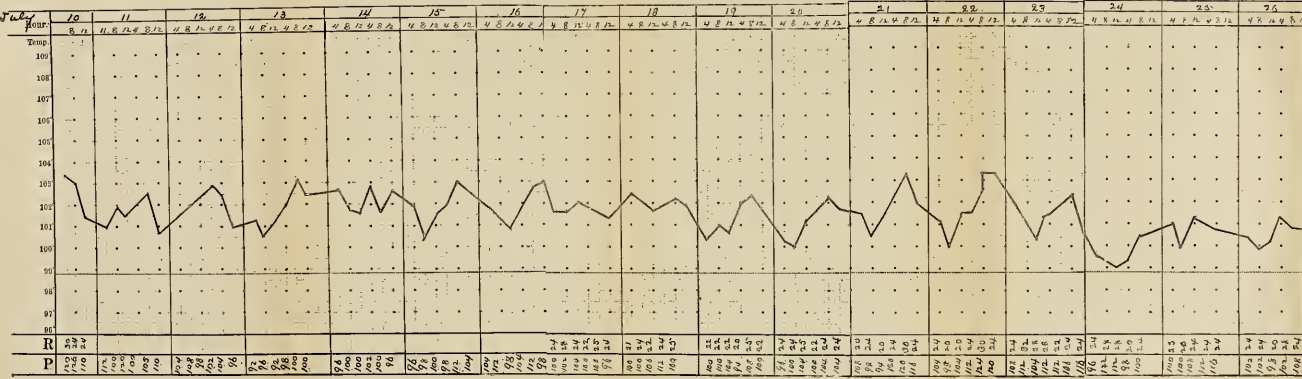
August 19. By ophthalmoscope, right eye : at the macula there is a large red patch about one-half to three-quarters the diameter of the disc, evidently a recent retinal hemorrhage ; above and external to it, and only a very short distance away, is another one, very much smaller, perhaps one-fifth its diameter. Left eye : external to macula there is a hemorrhage much like that in the right eye, but much smaller. Examination of the field shows : right eye, blurring and reddening of vision at the centre of the field, so that the central vision is very poor. The peripheral parts of the field are normal. Left eye, central vision apparently normal (acuity not tested accurately), there is a narrowing of the field peripherally on the nasal side.

August 27. Culture from blood shows no growth.

Urine Examinations.—July 11. Color, amber, clear ; specific gravity, 1023 ; reaction, acid ; no sugar ; albumin, a trace ; leucocytes in fair number ; a great many vesical and vaginal cells.

July 24. Color, amber, slightly turbid ; specific gravity, 1020 ; reaction, acid ; no sugar ; albumin, a heavy trace ; a few leucocytes ; vesical and vaginal cells.

July



The patient now was discharged from the hospital at her own request.

The history of her condition after she left the hospital, as obtained from her friends, is as follows:

She improved somewhat at first, so that she was able to get up every day, dress herself without assistance, and go up and down stairs. Excepting for absence of appetite and weakness, she felt perfectly well. The pain in the left side was sometimes better, sometimes worse. About three weeks after leaving the hospital she had another attack of blindness in the same eye that was first affected. This, however, partially cleared up. Soon after this she had several attacks of sudden sharp pain in the region of the spleen. She then gradually grew weaker, and was unable to leave her bed. In the early part of November she had a sudden attack of hemiplegia, involving the left side of the face, and left arm and leg. She was able to speak a little, but with difficulty. She remained in this condition for about twelve hours and then became unconscious and died a few hours later.

In the two cases whose histories have just been given in detail, it is noted that both of the patients had had rheumatism, dating back to a point several months before the beginning of the illness for which they sought the hospital. In the second case, she had been told seven years before that she had a heart-murmur. Thus we may suppose that probably in both cases there existed a rheumatic endocarditis, which would offer the necessary foundation upon which the diplococcus infection might become engrafted.

In neither case was any superficial lesion noted which might have offered a point of ingress for the bacteria. In many of the cases of malignant endocarditis that are met with, it is impossible to discover the lesion that has admitted the infection to the blood, and it has been customary to speak of these as cases of primary or idiopathic malignant endocarditis. It seems fair to assume that these cases differ from those of known origin only in the fact that the initial lesions have been so slight, or in such obscure situations, that they have been overlooked. When we consider how often the micrococcus lanceolatus is met with in healthy saliva, and the frequency with which superficial lesions of the mucous membrane of the mouth exist, we can readily understand at least one of the routes by which the bacteria may find their way into the blood-current.

The infective material having found its way into the blood, it then becomes a question how it reaches the heart-valves and sets up the local inflammation ; whether it travels in the main blood-current and lodges on the valve surface, where a lesion has already existed, or whether it reaches its destination by way of the coronary arteries.

Haushalter⁵ observed and reported an interesting case of pneumonia which has a possible bearing upon the condition in question. The case was one of acute lobar pneumonia, with fatal termination. The lung was found to contain the micrococcus lanceolatus in large numbers. The endocardium appeared normal to the naked eye, with the exception that there was a small particle of fibrin firmly attached to it at the insertion of one of the mitral valves. In this no bacteria were found, but upon microscopical examination of the valves themselves, they were found to contain diplococci in considerable numbers embedded in the connective tissue. The substance of the valve appeared in other respects perfectly normal. He concluded that the bacteria had arrived at the place in which they were found by way of the coronary blood-vessels, and that they perhaps represented the initial stage of pneumonic endocarditis. He suggests that possibly this is the mode of origin of cases of chronic endocarditis occurring as sequelæ of pneumonia and of the other acute infectious diseases. It is the experience, however, of most other observers, that in experiments upon animals, malignant endocarditis is set up by intravenous injection of pathogenic bacteria only when there is at the same time a lesion of the valves themselves. The weight of evidence is strongly in favor of the general blood-current as the carrier of the infection. As has already been mentioned, it is possible in animals to set up an ulcerative inflammation of the aortic valves by first passing a wire down the carotid artery, and in this way producing a mechanical injury of the valves, and then injecting a pure culture of one of the pyogenic organisms into a vein ; moreover, the non-vascular character of the heart-valves themselves makes it seem unlikely that the coronary artery is the route by which the infection travels. So that in spite of Haushalter's interesting observations, the impression remains that the bacteria reach the surface of the heart-valves by way of the general blood-current.

Where endocarditis pneumonica occurs as a complication of acute

lobar pneumonia, it is easy to understand the origin of the affection of the heart-valves and the method of inoculation, for the fact has been demonstrated that, in many cases of pneumonia, especially in those of severe type, the micrococcus lanceolatus finds its way into the blood-current and suffers a fairly wide distribution throughout the body. For instance, Orthenberger, examining the tissues of six fatal cases, found the micro-organism in the liver, spleen, and kidney generally situated within the lumen of the blood-vessels.

Queissner,⁶ examining the lungs of children who had died of pneumonia, found the diplococcus in the lung situated within the lumen of the vessels.

Weichselbaum found the bacteria in the blood of fatal cases of pneumonia after death.

Kühnau⁷ examined the blood of nine cases of severe pneumonia, and in one was able to cultivate the diplococcus.

Where, however, there has been no antecedent pneumonia, it is often extremely difficult, or impossible, to discover the source of the bacterial infection. When we recollect the wide distribution of the micrococcus lanceolatus and the fact that it exists normally in the saliva in a large number of healthy persons, and that it is the pathogenic agent in a large number of cases of local inflammation in various parts of the body, one can more easily understand the not infrequent occurrence of this disease.

Netter,⁸ in 1894, reported an interesting case which illustrates well the ability of the diplococcus lanceolatus to originate an inflammatory process, or a series of inflammatory processes, closely resembling in their course and in their pathology those brought about by the usual pyogenic bacteria. His patient, aged 19 years, showed first a superficial abscess of moderate size on the leg and situated in close association with a small cavernous angioma. Soon there were evidences of a general systemic infection; there was fever of considerable degree, enlargement of the spleen, and the signs of infarctions in the lungs and of an acute endocarditis. The patient finally, but slowly, recovered, and was left with the signs of a valvular heart-lesion. During the course of the disease the micrococcus lanceolatus was found in the pus from the abscess, in the sputum, and once in blood taken from the finger-tip. The bacteria were demonstrated microscopically by culture and by animal inoculation. To this condition of general systemic infection with the micrococcus

lanceolatus, the French have applied the name *pneumococcie* ; the Germans, *pneumomykose* or *pneumococcæmie*.

Barbacci⁹ reports two fatal cases of *pneumomycosis* where there was no history and no signs of pneumonia. In one case there were purulent peritonitis and meningitis, and in the other peritonitis, meningitis, and endocarditis.

Netter² studied the relation of the *micrococcus lanceolatus* to inflammations of the various organs, and concluded, from an analysis of cases that have been reported, that in 100 cases of infection with this organism in adults there were :

Lobar pneumonia, 66 cases ; bronchial pneumonia, 17 cases ; meningitis, 11.5 ; inflammation of middle ear, 10 ; empyema, 8.5 ; malignant endocarditis, 5.7.

Weichselbaum, in 1884, made a strong plea for the recognition of the fact that this micro-organism is independent of any necessary connection with pneumonia. He states that endocarditis *pneumonica* is of considerable frequency ; that pneumonia may precede it, or follow it, or not be present at all. Again, in 1889, he reports a case of peritonitis caused by this agent and in which the disease appeared to be primary ; at least, he was unable to discover any antecedent cause.

Recently, in 1897, Garrod¹⁰ has reported in detail a case of endocarditis *pneumonica* in which cultures from pus found in the middle ear showed the presence of the same bacteria, and in which it seemed at least possible that the inflammation in this locality was the starting-point for the general infection.

When we come to consider the pathological anatomy of the disease, we find that most observers agree that the lesion in the majority of cases has its seat in the left side of the heart. A few cases have been reported of endocarditis *pneumonica* affecting the valves of the right side, both the pulmonary and tricuspid, but these are, according to most observers, infrequent. In both of the present cases the lesion was of the mitral valves.

As regards the character of the inflammatory changes, it has generally been believed that in these cases the vegetations are apt to reach an enormous size. Smith has described a case in which they measured one and one-half inches in length. Moreover, it is generally believed that the vegetations are more apt to be of the verrucose than the ulcerative variety.

Weichselbaum, examining seven cases in reference to this point, however, found that six of them were ulcerative. Aublé concludes from a study of the literature that the verrucose form is the more common, and that the surface of the vegetations is apt to be very smooth. In this way is explained the comparative immunity from embolic accidents which these patients have been supposed to present, this being the result, as it is said, of the diminished opportunity for the formation of coagula or fibrin on the valves; while in malignant endocarditis caused by the ordinary septic organisms, such accidents are supposed to occur much more frequently.

In the case of Wilhelmina B., in which an autopsy was made, the vegetations were of very large size, and showed no apparent ulcerations, but a surface that is described as irregular and ragged and with coagulated fibrin upon it. The microscopical examination, too, leaves it still uncertain whether the condition should properly be called verrucose or ulcerated. Indeed, it seems best not to use the terms ulcerated and non-ulcerated as indicating distinct and separate pathological processes when applied to heart-valves which are the seat of endocarditis; for, in the first place, the distinction is one which cannot in every case be positively made at the post-mortem examination, and, moreover, the question whether the lesion is or is not to be an ulcerative one in any given case of malignant endocarditis, seems to depend rather upon chance than upon the nature of the infection and the character of the disease.

It has generally been claimed that embolic accidents are of much less frequent occurrence in endocarditis pneumonica than in cases of malignant endocarditis brought about by the streptococcus pyogenes, and this relative immunity from such complicating lesions has been said to depend upon the smooth and non-ulcerated character of the surface of the vegetations upon the heart-valves in the former cases, thus offering less opportunity for the coagulation of fibrin upon the valves and for the subsequent production of emboli (Netter).

Claissé¹¹ says that purpura is very rare in endocarditis pneumonica. Others, however, basing their conclusions upon individual experience, have claimed that complicating lesions are just as apt to occur in this as in the other forms of malignant endocarditis, and in their character are not to be distinguished from them.

In the first of our cases, Wilhelmina B., there was cerebral em-

bolism, and, as shown at the autopsy, septic infarctions in the spleen and kidneys.

In the second case, Margaret S., the only evidences of emboli discovered were a few petechiæ on the limbs and the retinal hemorrhages above described. After leaving the hospital, however, she had symptoms which point probably to infarctions in the spleen, and a hemiplegia which it seems fair to refer to cerebral embolism.

The conflicting statements met with, as to the liability to these accidents in this disease, are probably the result of too great readiness to generalize from a few cases. The number of cases carefully reported up to the present time is too small to justify such generalizations. It is certainly fair, however, to say that any embolic complication may, and at least occasionally does, occur in the course of this disease. Probably, petechiæ are less frequently met with than in the septic form. It seems likely that the micrococcus lanceolatus lends itself less readily than does the streptococcus pyogenes to the development of metastatic inflammations, for in the very common disease, acute lobar pneumonia, in spite of the fact that at least fairly often the bacteria find themselves in the blood-current, nevertheless such complicating inflammations are exceedingly rare. Perhaps this is because the micro-organism is especially susceptible to the bactericidal action of the blood-serum. There is one very serious complication which is especially liable to occur in the course of endocarditis pneumonica, namely, acute meningitis, with the presence in the inflammatory exudate of the same bacteria that occur in the heart-valves.

Netter says that meningitis occurred in seventy-eight per cent. of his cases.

In our two cases there were no evidences of meningitis.

When we come to study the symptoms of the disease, we find that here again there is much disagreement among the statements made by different observers.

According to Netter and others, endocarditis pneumonica runs a somewhat characteristic clinical course, and differs in its symptoms from the other forms of malignant endocarditis. He says that its duration is apt to be shorter; that it goes on more rapidly to a fatal termination. The most rapid of Netter's cases was fatal in five days. Recognizing from a clinical stand-point two types of temperature curve in malignant endocarditis, one the typhoid type with a fairly

continuous high temperature, the curve generally not making wide excursions, the other, the septic type, the degree of fever varying much from time to time and at short intervals, and the excursions of the curve being correspondingly extensive, he finds that in endocarditis pneumonica the fever generally approaches the typhoid type, while in the streptococcus variety it follows the septic or interrupted type. Jaccoud¹⁴ agrees in the main with Netter's conclusions, but does not believe that there is any definite relation between the variety of bacterium present and the duration of the disease.

In most of the cases from which the above deductions were made, the disease occurred as a complication of a very severe pneumonia.

Pinaud claims that there is no discoverable relation between the symptoms exhibited in any given case and the variety of micro-organism concerned in the production of the lesion; nevertheless, it seems reasonable to expect to find more or less characteristic differences in the symptoms presented by the two sets of cases.

The micrococcus lanceolatus, when it is exerting its effect in the place of its choice, the lungs, behaves in a strikingly uniform way. The characteristic mode of onset, course, and termination of acute lobar pneumonia, belong probably not to the tissue attacked, but to the peculiar relation which this bacterium bears to the human organism, for acute inflammations of the lungs, caused by other bacteria, do not at all conform clinically to the type of this disease.

In the first of our cases, Wilhelmina B., the temperature in the morning was always in the neighborhood of 100; in the evening, from 103 to 105; thus the excursions of the chart are very extensive, 4 to 5 degrees each day, but are at the same time strikingly uniform from day to day. The chart, looked at as a whole, is remarkably regular, and in this regularity differs from the usual charts of septic malignant endocarditis. Noticeable also is the entire absence of chills or chilly sensations and sweating.

In the second case, Margaret S., we find also a very uniform and regular temperature chart, the excursions, however, being smaller than those in the first case. Here also the entire absence of chills or chilly sensations is noted.

In the first case the patient was under observation in the hospital four weeks, at the end of which time she died.

In the second case, she was in the hospital forty days and was

then discharged at her own request, in a somewhat better condition than when first admitted. She subsequently died of the disease, but not until five months from the commencement of the attack. In the pulse, respiration, and other symptoms, the histories show no characteristic points that throw any light upon the condition.

AS REGARDS DURATION AND TERMINATION.

In their duration our two cases are much at variance with the statements that have generally been made to the effect that endocarditis pneumonica is remarkable for the rapidity and shortness of its course. One lasted four weeks, the other about five months.

As regards termination, the cases both ended fatally. In this connection, a case reported by Shattuck¹² is of interest. The patient, a young woman, had pneumonia of the left lung, then of the right. Following this, there were great irregularity of pulse, respiration, and temperature, with very marked prostration, both physical and mental. There were pain in the precordium, and several mild chills and shiverings. There was a mitral systolic murmur.

The patient recovered, but convalescence was slow.

Shattuck regards it as endocarditis pneumonica with recovery.

The relative frequency of pneumonic endocarditis, as compared with the other varieties of the disease, is difficult to determine. Of 21 cases of malignant endocarditis studied by Weichselbaum, 7 were of this type.

Of 4 cases that have been under observation in the Presbyterian Hospital during the past year, 2 showed micrococcus lanceolatus; 1 streptococcus pyogenes; 1 staphylococcus pyogenes aureus.

It is a singular fact that in most of the cases that have been reported of diseases other than pneumonia caused by the micrococcus lanceolatus, both the pathological processes and the clinical manifestations have been entirely different from those exhibited when the same micro-organism produces its characteristic effects in the lungs.

In almost no other disease is the tendency to definite self-limitation and to conformation to a recognized clinical type more clearly shown than in acute lobar pneumonia. The sudden onset, the rapid course, the almost certain subsidence of the symptoms by crisis at the end of a definite period, all go to make up the familiar picture of the disease.

It is not easy to understand why the disease should show this tendency to strict self-limitation and to strictly conform to a definite type when it has its seat in the lungs, while when it attacks the endocardium or peritoneum or pleura or meninges, it is not only capable of, but usually succeeds in extending its career over many weeks or months, and in different cases shows a very marked lack of uniformity. It is, of course, possible that the micrococcus lanceolatus may find in the lungs the conditions best suited to further its rapid growth, and the speediest possible production of its various chemical life-products, its toxins and antitoxins, and this may account for its rapid self-limitation in this situation. Nevertheless, it is certainly a suggestive fact that acute lobar pneumonia practically always behaves in its typical way, while similar infection in other parts of the body never conform, as far as is known, to any clinical rule, even when the process is one of very great intensity.

This suggests the possibility that in many, and perhaps all, of the cases under discussion, the micro-organism which brings about the disease may be different from the diplococcus of acute lobar pneumonia in many of its essential vital features; in fact, a different bacterium. It must be remembered that even the most thorough laboratory methods for the differentiation and study of bacteria are at best imperfect, and teach us but little of their physiology.

In this connection much interest attaches to a series of cases published by Leyden.¹³ In four of six fatal cases of rheumatic endocarditis, he found a diplococcus in the heart-valves, which was declared by Gunther to differ from all the micro-organisms that have been described in connection with malignant endocarditis. It is a diplococcus, but shows enough points of difference from the micrococcus lanceolatus to make him feel justified in publishing it as a new species of bacterium not previously described.

The conclusions arrived at from a study of all the published cases that have been available, together with the two reported in this paper, are as follows:

- 1st. That endocarditis pneumonica is of fairly frequent occurrence, and constitutes an important part of all of the cases of malignant endocarditis.

- 2d. That it need not necessarily complicate pneumonia, but, on the contrary, often occurs without a discoverable cause.

- 3d. That probably a pre-existing lesion of the endocardium,

generally a rheumatic endocarditis, is necessary to the development of the disease.

4th. That the onset may be either rapid or slow, but probably in cases not complicating a pre-existing pneumonia is apt to be more gradual than in cases of malignant endocarditis caused by the streptococcus pyogenes.

5th. That the duration of the so-called idiopathic cases may be many weeks, or even months.

6th. That the temperature, pulse, and respiration exhibit a much more regular and symmetrical chart than is the case in septic malignant endocarditis.

7th. That the vegetations are apt to be larger, and not ulcerated.

8th. That embolic accidents occur almost, if not quite, as frequently as in the other forms of malignant endocarditis, and that a petechial rash is often present.

9th. That blood-culture experiments, if carefully and thoroughly carried out, will generally show cultures of the micrococcus lanceolatus.

The following table contains a list of only the most important of the publications made use of. For a full table of the literature of the subject the reader is referred to the paper by Kerschensteiner—Muench. Med. Woch., 1897, pp. 808, 836, 857.

1. WEICHSELBAUM: Wiener klin. Woch., 1888, Nos. 28-32; Wiener Med. Woch., 1888, Nos. 35-36; Ziegler's Beiträge, Bd. IV., 1888, p. 127.
2. NETTER: Arch. de Med. Exper. et Anat. Path., 1890, 677.
3. MEYER: Deut. Arch. für klin. Med., 1887, p. 433.
4. BANTI: Ueber d. Ätiologie der Pericarditis, Deut. Med. Woch., 1888, No. 44.
5. HAUSHALTER: Revue de Med., 1889, p. 328.
6. QUEISSNER: Jahrb. f. Kinderheilkunde, 1889, Bd. XXX.
7. KÜHNAU: Zeitschrift f. Hyg. und Infectionskhntn., vol. xxv., 1897, p. 492.
8. NETTER: Bull. et Mem. de la Soc. Méd. des Hôp., 1894.
9. BARBACCI: Lo Sperimentale, August 31, 1892.
10. GARROD: British Medical Journal, 1897, I., p. 332.
11. CLAISSÉ: Arch. de Med. Exper. et Anat. Path., 1891, p. 379.
12. SHATTUCK: Boston Medical and Surgical Journal, September 22, 1892.
13. LEYDEN: Deut. Med. Woch., December 6, 1894.
14. JACCOUD: L'Union Médicale, February 28, 1890.

XXIII.

A COMBINATION STAIN FOR GANGLION CELLS.

BY EDWIN S. STEESE, M.D.

ALTHOUGH a preliminary report, somewhat similar to this, was read before the New York Pathological Society some time since, it seems appropriate that a second and more exact one should appear in the Annual Report of the Presbyterian Hospital, the work having been done in its pathological department. The method is as follows :

Small pieces of tissue, not more than four millimetres in thickness, and as fresh as possible, are fixed, hardened, embedded in celloidin, and cut in the usual manner. Almost all of the methods adapted to cell-examination may be used and good results obtained. A four per cent. solution of formalin, for at least twenty-four hours, is, however, especially serviceable, being easily prepared, fixing the cells rapidly and uniformly, and producing at the same time an elastic condition of the tissue, which allows of considerable handling without serious injury. Specimens having remained in this solution for eight months, stain beautifully and cannot be distinguished from those which have been finished rapidly.

Absolute alcohol and corrosive sublimate solutions are also useful, but the pieces of tissue must be very small, and, even then, many cells will be found seemingly untouched by the fixing fluid.

If the mercurial is employed, considerable handling is compulsory to avoid precipitation of the salt, and this extra manipulation condemns its use with delicate, nervous tissue.

Everything considered, formalin is preferable to any other agent which has as yet been tried.

The staining solution is as follows :

Methylene blue, one per cent. aqueous solution.....	2.0
Fuchsin, saturated aqueous solution.....	6.0
This mixture can be used immediately, but improves with age.	

To stain, place three or four sections only in a watch crystal two-thirds full of the fluid, and heat over a spirit lamp until vapor is perceptible rising from the surface. Allow to cool for one minute and transfer directly to alcohol (ninety-five per cent.).

The sections will differentiate, and dehydrate very rapidly, and must be kept in constant motion.

When they appear to be without color, transfer them directly to oil of origanum, in which they will clear quickly.

Specimens may remain in the clearing solution several days without suffering loss of color, but it is advisable to mount them as soon as possible in balsam or dammar.

On microscopic examination the cells will be found to stand out in marked contrast to the sustentacular tissue, which is of a pearly white color. Nissl's bodies are of a deep purple and can be traced far out in the dendrites; nuclei have a lavender tint, while the nucleoli and pigment-granules are stained red. This is also the color of most of the round cells, but some appear purple, and others are of intermediate shades. Occasionally the ganglion-cell nucleoli assume a bluish shade.

For general work in cellular structures the results are equally good.

Contrast stains may be employed, and eosin is recommended.

Several specimens having lain in the sunlight during the last six months without suffering loss of color, the permanency of the stain seems well-established.

XXIV.

CONGENITAL TUMOR OF THE HARD PALATE.

BY WM. N. BERKELEY, M.D.

History.—On June 15, 1897, an infant, half an hour old, born at or near term, was admitted to the Presbyterian Hospital with a tumor projecting from the mouth (Fig. 1). The tumor is said to have been as large, at this time, as a man's fist, tense, smoothly nodular, glistening like peritoneum, and was attached by a pedicle $2\frac{1}{2}$ cm. (1 inch) in diameter to the posterior part of the hard palate just in front of the soft palate. The growth was removed at once by Dr. Andrew J. McCosh, the pedicle being slowly charred through by a galvano-cautery snare, the wire of which was not allowed to reach a "red heat." There was practically no loss of blood. No anæsthetic was employed and no signs of shock followed the operation. The patient did well temporarily, but the discharge from the mouth soon set up an aspiration-pneumonia. The father took the baby home after a day or so. It died there, with high temperature and rapid pulse, on the fourth or fifth day. *Post-mortem* by the coroner confirmed the diagnosis of pneumonia.

Gross Anatomy.—The specimen (Fig. 2), after lying in four per cent. formalin for some months, has shrunk to nearly half the original volume. It is now about 10 cm. (4 inches) long, 5 cm. (2 inches) in greatest width, 51.5 grammes ($1\frac{3}{4}$ ounces) in weight, and has several hour-glass constrictions and polypoid knobs. The surface is smooth to the touch. On section (Fig. 3) the growth is seen to be partly cystic, partly solid and firm. The cysts originally held a clear serum. They are probably dilated lymph-channels. There are also a few nodules of cartilage visible to the naked eye, and several small, yellow, cheesy masses suggesting inspissated gland-secretion. At the point of attachment is still to be seen some of the palatal cartilage.

Microscopical.—Sections from various parts of the tumor show



FIG. 1.—CONGENITAL TUMOR.

the solid tissue to consist largely of very small and capillary blood and lymph vessels ($10-20\ \mu$ in width). Some of the vessels are much larger ($100-300\ \mu$ wide). They lie in a firmly reticulated or granular connective tissue, which is frequently of the embryonal type.

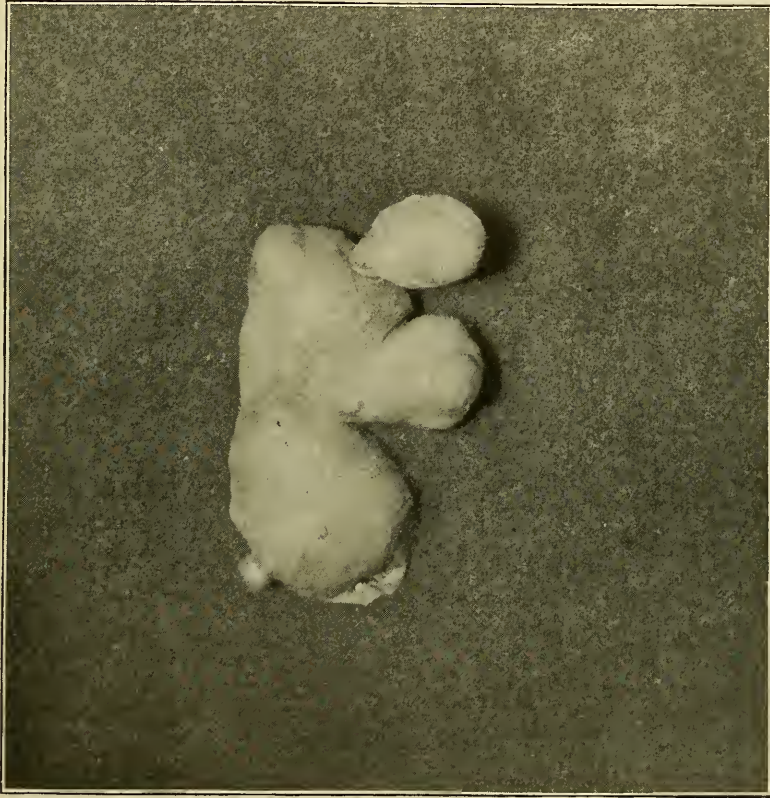


FIG. 2.—CONGENITAL TUMOR.

This tissue contains cells with round and oval nuclei, of small and medium size, sometimes quite closely crowded. In some places the vessels make almost a solid mass, with neither connective tissue nor cells between. Adipose is sometimes found. Leucocytes are collected here and there in heaps outside the vessels. There are many minute encapsulated groups of closely crowded cartilage-cells,

both nuclei and cell bodies staining a deep blue with hematoxylin. Non-striated muscle is scantily found. A few irregular spaces, lined with nearly cubical cells, and showing papillary ingrowths, look like altered gland-alveoli. The covering is thin, of stratified epithelium, which is sometimes squamous, sometimes columnar. The colum-

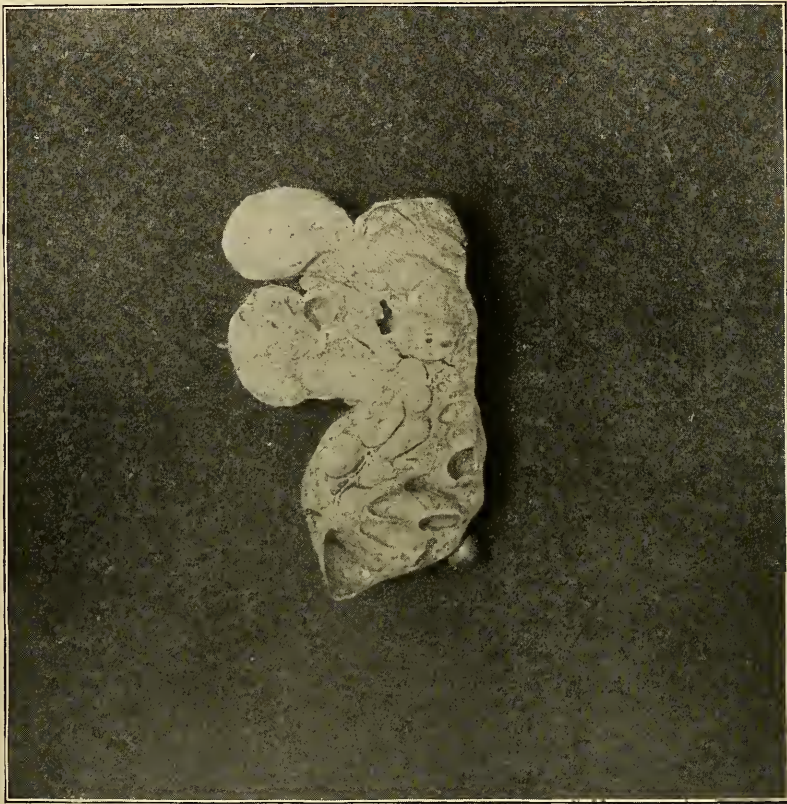


FIG. 3.—CONGENITAL TUMOR.

nar form shows indefinite traces of ciliation. No part of the covering that was examined contained hairs.

The tumor may be viewed as a congenital hæmo-lymphangioma, or more strictly perhaps as an antochthonous teratoma—a malposition of tissue-elements in the development of the fœtus.

Examination of the literature shows that while congenital vessel-

tumors of the mouth do occur (Ziegler, *Path. Anat.*, 1890, II. Band, § 184; Butlin, H. T., *Diseases of the Tongue*, 1885), they are oftenest attached to the tongue, and seem rarely of the size of the present case. The following quotations are interesting in this connection:

Hickman reports (*Trans. Path. Soc. London*, 1879, XX., p. 160), in a child dying of suffocation sixteen hours after birth, a tumor $\frac{3}{4}$ in. $\times$ $\frac{1}{2}$ in. $\times$ $\frac{1}{2}$ in., broad base, lying lengthwise above the epiglottis. It was found to be full of vessels and ducts, supported by connective tissue—apparently a hypertrophy of structures normal to the part.

Clérault (*Bull. Soc. Anat. de Par.*, 1874, XLIX., p. 380) reports a congenital tumor of the palatine vault in a child who did well after removal of the growth with a bistoury. The tumor was bilobular, rose-colored, covered with fine lanugo-hairs, and was 6 cm. $\times$ 6 cm. $\times$ $1\frac{1}{2}$ cm. It did not project far from the mouth, and was at first taken for the tongue. Section showed cellular tissue containing fat. The covering was flattened epithelium closely resembling skin. The lanugo-hairs had sebaceous glands attached, but there were no papillæ. A few *striated* muscular fibres were present. The child had a partially cleft palate, but the tumor grew from the solid vault in front of the cleft. The author states that he was able to find nothing similar reported in the literature.

XXV.

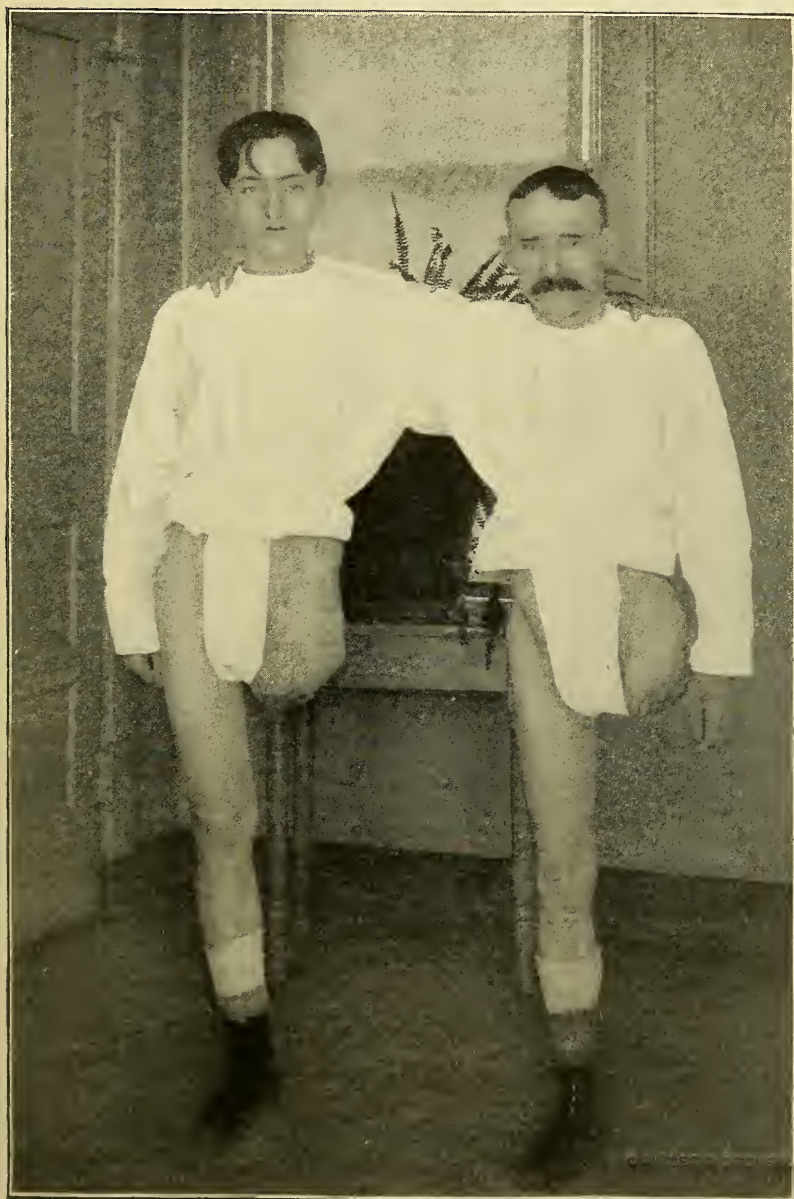
TWO CASES OF AMPUTATION THROUGH THE HIP-JOINT.

BY CHARLES K. BRIDDON, M.D.

THESE cases were both inmates of the Presbyterian Hospital in the spring of the present year, the first for the treatment of a rapidly growing osteo-sarcoma of the lower end of the femur, the second for old, intractable hip-disease. The results in each were all that could be desired, the only drawback being a small fistulous sinus in the case of caries.

CASE I. M. P. A., aged fifteen; single; electrician; United States. Was admitted to the male ward on March 13, 1897, with the following history: Three and one-half months before admission he struck the inner side of his left knee against a post, causing a considerable amount of pain and tenderness for several days. Two weeks later he noticed a small, painless swelling on the inner side of the lower end of the left femur. This swelling gradually increased in size until three weeks ago, since which time its growth has been rapid. For three weeks there has been pain in the tumor, which is greater in severity at night. It has also been somewhat tender to pressure. He has not limped and has walked perfectly well. He has neither lost flesh nor strength, and has always enjoyed excellent health. He has been on inunctions of mercury and increasing doses of potassium iodide, but these have not affected the growth of the tumor.

A physical examination revealed the following facts: The patient was well-nourished, not anæmic; his thoracic and abdominal viscera were normal; the inguinal glands on both sides were palpable; the other superficial glands were not found enlarged. The left knee-joint was swollen and enlarged, evidently contained sufficient fluid to cause the patella to float. Circumference of left knee one and one-



half inches more than that of right knee. Seven inches above patella left thigh shows atrophy of one inch in circumference as compared with right thigh. No shortening of leg, no atrophy of calf. On the inner aspect of the left thigh, at a level with the upper end of the patella, there was a tumor which was elastic to the feel, not tense, not fluctuating. The skin over it was movable. The tumor was not freely movable upon the underlying tissues, but it did not appear to be fastened to bone. There was no limp or pain on walking.

Tumor is 3×2 inches, and raised about half an inch above the level of the surrounding tissues.

The patient was observed for a week, and as the tumor was evidently increasing in size, a diagnosis of sarcoma was made and amputation at the hip advised.

On March 24 the patient was placed under ether. The tumor was incised and a specimen given to the pathologist (who was present) for immediate examination. He at once reported it to be sarcoma of a malignant type. The incision was hastily closed with sutures and the instruments used for the purpose of examination discarded. An Esmarch's bandage was applied to the leg (while elevated), from the toes to a point two inches below the knee. Hemorrhage was controlled by Wyeth's method of pins—one passed in at a point two inches below the anterior superior spine and emerging posteriorly on a level with the great trochanter; another passed through the tissues on the inner aspect of the thigh from a point one inch below the crotch and emerging posteriorly. A pad $4 \times 2 \times 2$ inches was placed over the femoral vessels as they emerged beneath Poupert's ligament, and this was held in place by six turns of heavy rubber-tubing carried over the pad above the pins and around the thigh. This, as subsequently proved, absolutely controlled all hemorrhage.

A circular incision, six inches below the tourniquet, was carried down to muscle, and this was joined by a vertical incision, beginning over the great trochanter, and carried downward. A cuff, composed of all tissues down to muscles, was next raised and reflected to a point on a level with the lesser trochanter, where a circular incision was carried through all the tissues down to bone. The muscles were now raised from their attachment to the femur; on reaching the capsular ligament, an assistant placed it on the stretch by

rotating and flexing the femur, while the operator quickly cut through it into the joint, and completed the amputation. The femoral vessels were seized and tied with silk, the remaining vessels with catgut. The sciatic nerve was drawn out, and about an inch cut away. The tourniquet was then removed and the few bleeding points remaining were caught and tied. The acetabulum was drained by a wick of iodoform gauze, carried through the upper angle of the wound. The flaps (muscles and superficial tissues) were brought together with silk-worm-gut; the skin, with catgut sutures; copious dressing applied. Practically, no blood was lost, and the patient suffered very little shock.

On the day following operation the patient had a pulse of 120 and a temperature of 102° F.; these were the greatest of his convalescence. On the third day his pulse fell to 90, and his temperature at the end of a week was normal. A few small doses of morphine, and mild stimulation with strychnine and whiskey, included his entire medication. The flaps healed by primary union. One week after the operation he was put on small doses of Fowler's solution, which were gradually increased to the point of toleration. On the eighteenth day he was out of bed and was discharged from the hospital, cured, and walking well on crutches on May 3, when he seemed strong and well.

The pathologist, Dr. Thacher, reported the tumor to be a sarcoma of spindle and giant cells, growing from and involving half of the thickness of the femur.

CASE II. J. E. D., aged thirty-three; single; clerk; United States. When eight years of age, patient, as far as he knows, first had trouble with his left hip. At that time there were no abscesses, and he was treated at the Hospital for Ruptured and Crippled for twenty months; at the end of this period he was able to use his leg well until sixteen months ago, when the same hip became sore and tender; there was much pain localized in the left knee, abscesses began to form in the neighborhood of the hip, and the leg began to draw up. Six months ago he entered one of the large general hospitals of the city and was operated upon. At this time the head of the femur was found to be dislocated backward and firmly ankylosed. Excision was thought impracticable, but a considerable portion of diseased bone was removed from the region of the trochanter major;

one focus in the acetabulum was curetted and numerous abscesses were drained. He was in the hospital for three and one-half months, but the sinuses have not healed, and he has not been able to use the limb to any extent. He has not improved in general health, and has been advised on several occasions to have the leg amputated.

On admission to the hospital, February 4, 1897, the patient appeared rather poorly nourished, anæmic, tongue slightly coated, heart normal. His lungs were negative, except for a few scattered sibilant râles and some old pleuritic râles. The left hip was the site of an old inflammatory process; along the outer aspect there was a scar in which there were two discharging sinuses; above these, four inches below the anterior superior spine, there was a second scar, also having a discharging sinus. The hip was ankylosed at an angle of one hundred and thirty-five degrees. The left limb was extremely atrophied. A probe passed into the sinuses detects dead bone at distances varying from three to five inches from the surface. The urine was normal.

Preparatory to performing amputation a few sinuses were opened more freely and were dressed each day, with the hope of cleaning away some of the pus.

On February 17 the patient was given ether, and the limb removed at the hip-joint. The hemorrhage was completely and satisfactorily controlled after the method of Wyeth. At a point five inches below the tourniquet a circular incision was made through skin and subcutaneous tissues; this was joined by a vertical incision from the trochanter major downward. The skin-flap was reflected for a distance of two and one-half inches, and at this point the muscles were divided down to bone, and the vertical incision carried down to bone. The only blood lost was a small amount from the limb below the incision. The muscles were now rapidly raised from their bony attachment and the great trochanter and part of the neck exposed. On account of the firm ankylosis of the head it was found impossible to gain access to the joint; accordingly, the neck of the femur was divided with a chisel, and the extremity removed. The head was next removed by means of the chisel, exposing the remains of the acetabulum, which was found much diseased; in curetting this out the pelvic cavity was opened, the disease having involved the whole thickness of the ilium. The diseased capsule was cut away and the sinuses in anterior flap thoroughly scraped. Ves-

sels were now caught separately and tied with catgut, and the tourniquet and pins were removed; there was but slight oozing from the raw surfaces, and but one or two small arteries required ligature after the removal of the tourniquet. The muscles were approximated with catgut, and the skin with silk-worm-gut, a space being left at the upper and outer angle of the wound to allow of the insertion of a drain to the acetabulum. Aseptic dressing applied with moderate pressure. Patient returned to ward in fair condition; a few hours later his pulse became somewhat weak and went up to 160, but it responded readily to rectal stimulation of hot salt solution and whiskey. Pain and restlessness were controlled by small doses of morphine.

For the six days following operation the temperature ranged from 101° to 104° F., and the pulse was above 140, but from this time on they rapidly improved and fell to normal.

Convalescence was slow and the sinuses were long in closing, the one leading to the acetabulum being open at the time of his discharge. Treatment consisted in frequent nourishing food, alcoholic stimulation, principally in the form of Burgundy, and carefully selected nourishing food.

On March 2, patient sat up in bed, and two weeks later got about on crutches. He was discharged on June 4, a small sinus two and one-half inches deep still remaining.

The pathologist reports that portions of the tissues about the hip show distinct tubercles.

XXVI.

THE SURGICAL TREATMENT OF EPILEPSY, WITH A REPORT OF FOURTEEN CASES.

BY ANDREW J. MCCOSH, M.D.

THE results of operation for epilepsy, or indeed for any cerebral lesion, not the immediate result of traumatism, have been rather discouraging as far as the cure of the patient is concerned. The expectations which were held out to the surgeon a dozen years ago, when brain-localization seemed to be making such rapid strides, have not as yet been realized. Among neurologists and surgeons there is at present a feeling of uncertainty, even of discouragement, in regard to the results of operations on the brain. It is true that certain brilliant results have been reported, but generally these have been in isolated cases, and often the report has been made before a sufficient time has elapsed for a definite decision as to the final outcome of the case. In this connection it might be well to emphasize the fact that it is misleading to report a case as "cured" until more than a year has elapsed since the operation. Reports made at an earlier date may be of interest from a pathological or symptomatic point of view; but as regards the outcome of the operation are worthless. It will be found, I think, that in every long series of reported operations for the cure of epilepsy, the large majority of the patients have not been benefited by the operation, and that the number of permanent cures is lamentably small.

This lack of success in cranial surgery is due to various reasons, prominent among which are the following:

First. Uncertainty in diagnosis. In the motor areas of the cortex the location, if not the character, of the lesion can be determined with reasonable uncertainty, but the diagnosis of lesions in the frontal, occipital, and deeper regions is still apt to be unreliable. Anyone who has witnessed many brain operations can testify as to the disappointment of the surgeon and perhaps the surprise of the neu-

rologist when the suspected area of the brain contains no lesion visible, at least to the naked eye. In the practice of most surgeons this has occurred so frequently that many of us feel very sceptical as to what will be found in any given case when the skull has been opened.

Second. The inaccessibility of certain portions of the brain. While it is true that every point of the cortex can be reached, and that we can gain access to some of the deeper convolutions, yet certain portions of the brain must always remain inaccessible to the surgeon.

Third. The character of the lesion. This may be such as to render its removal either impossible or unadvisable, as, for example, a disseminated malignant, or even tubercular, growth; or it may be of such an ill-defined character that with the naked eye it is impossible to distinguish diseased from healthy brain-tissue. The change in the cells may be so slight that even with the microscope it is difficult to affirm that the disease is sufficient to produce epilepsy; on the other hand, the fault may be in the blood-supply rather than in cell-degeneration.

Fourth. The post-operative lesions. As the result of operation a cicatrix may remain in the cerebral tissue, thickening of the membranes or adhesions between the pia and dura may result, or finally a depressed cicatrix may become adherent to the cortex; any of which lesions may continue to act as a source of cortical irritation and prevent the cure of the epilepsy. In recent years these post-operative lesions have been frequently advanced as reasons for the frequent failure of cerebral operations. I think, however, that their importance may have been somewhat exaggerated. I believe that in some cases they may act as a strong irritant when the cerebral tissue of that particular patient has become exceedingly sensitive owing to long-continued irritation. The theory, however, that such irritating cicatrices are of common occurrence, seems to me to be somewhat invalidated by the fact that in recent traumatic cases, extensive operations on skull, membranes, and brain can be done almost with impunity as far as fear of future epilepsy is concerned. Most of us are familiar with the extensive lacerations and loss of cerebral tissue which occur as the result of injury, and yet if the depressed bone is thoroughly removed, how rare it is to see any epileptic seizures follow the traumatism. Cases 12 and 13 of this

series, however, well illustrate the irritative properties of such cicatrices.

Fifth. The damage which has already been done to the cerebral cells by the lesion for which the operation is performed. In cases where the irritation has persisted for years this damage is often irretrievable.

While it is true that the results of operation for epilepsy have been somewhat discouraging, yet we must bear in mind the condition which we are striving to cure. The disease is progressive and hopeless. If unrestrained, it generally ends in a condition worse than death. It seems justifiable in many such cases to make an attempt to relieve the patient by means of operation, provided that there is even a faint chance of effecting a cure. The danger to life is comparatively slight, and in certain cases there is a chance that improvement, at least, may follow. Of course I am now referring only to cases which seem appropriate for operative interference, where we can with reasonable certainty locate the lesion and feel that there is a chance that it can be removed. In the great majority of cases this cannot be done, and, consequently, it is only a very small proportion of epileptics who can justifiably be advised to submit to operative interference.

Methods of Operation.—The mortality of cranial operations for the cure of epilepsy is comparatively small. The dangers, however, of operations for other cerebral lesions, such as tumor or abscess, are considerable. This is due, however, more to the nature of the lesion than to the operation itself. Various methods have been proposed and practised for exposure of the brain. Considerable difference of opinion exists as to the best method for opening the skull. That method is the best which is attended by the least amount of shock, and which at the same time will afford a free exposure of the cerebral cortex. In regard to the first of these requisites, time and hemorrhage are the most important factors. As a rule, the skull is opened and an exposure of the brain made by one or other of the following instruments :

(*a*) The trephine ; (*b*) the trephine and bone forceps (aided, perhaps, by the saw) ; (*c*) chisels ; (*d*) saws (or burrs) worked either by the hand or by a motor.

Each one of these instruments has its advantages and disadvantages. The trephine is easily managed, and its use is attended by

very little hemorrhage and by no concussion of the brain; on the other hand, it is often unwise to replace the bone thus removed, and it is not an easy task to expose by this instrument alone a very large area of the brain. The same remarks apply to the method by which the trephine-opening is enlarged by means of bone forceps, though in this way a large opening can be made more quickly, and if, in addition, the amputating saw is employed to make partial incisions through the skull, large portions of bone can be removed with great rapidity; indeed, this is the most rapid of all methods if the powerful bone forceps of Horsley are employed. Dahlgren's forceps have been extensively used in certain districts of Europe, but, personally, I have not found this instrument satisfactory.

In regard to the use of chisels, there is a decided difference of opinion among surgeons. Those with the largest experience, such as Horsley and Macewen, object distinctly to the employment of these instruments on account of danger of concussion to the brain and of shock. As advocates, however, of this method are surgeons with perhaps an equally large experience, such as Czerny, Schede, and Bergmann. By means of the chisel and mallet it is certain that a convenient exposure, by an osteoplastic flap, can be made of large areas of the cortex. The loss of blood, however, is considerable, and the danger of injury to the brain by the concussion of the mallet cannot be ignored. In regard to the time consumed in exposing the brain, this method has probably no advantage over that of the trephine and forceps. Its main advantages are that it enables a large exposure of the brain to be made, and that the bone can be replaced at the end of the operation.

The saws or burrs driven by mechanical power have a certain distinct advantage over all other instruments. This consists in the rapidity with which, *under favorable conditions*, a large opening can be made in the skull. As yet, however, conditions are often unfavorable, neither the mechanism of these instruments nor our skill in handling them being entirely satisfactory. The power is at times difficult to control, and most of us need more practice in their manipulation. The saws manipulated by the hand are unsatisfactory, with the exception of Gigli's wire saw, which seems to be a most useful instrument.

A considerable number of operations for epilepsy have been reported, but more are needed before a just estimate can be made of

the proportion of cures. While isolated cases from a surgeon's experience may be of interest in elucidating special points of symptomatology or treatment, yet the record of a surgeon's entire experience in this line of work is vastly more instructive. Most of us are apt to bear in mind our satisfactory cases, and perhaps to forget our ordinary unsuccessful ones; but it is exactly this latter class which impart value to statistics on this or, indeed, any other subject.

The histories which follow include all cases that have been operated upon by me for epilepsy. They are fourteen in number, and in all a year or more has elapsed since the date of their operations, which have been performed in the Presbyterian Hospital between June, 1891, and February, 1897. The results cannot be said to be encouraging when we consider that all the patients had been carefully selected after weeks or months of observation. In the majority the diagnosis had either been made or confirmed by a neurologist. In this connection I beg to express my thanks to Dr. M. A. Starr for referring to me several of these patients, and for his valuable advice as regards diagnosis and the propriety of surgical interference, and for his counsel at the time of operation.

These cases represent but a small proportion of the patients which during the past eight years have been sent to me for operation. In the others, careful hospital observation for a few weeks convinced us that they were utterly inappropriate for surgical interference.

The final result, after the expiration of one year or longer, has been as follows :

Cured, 3 ; improved, 5 ; unimproved, 4 ; unknown, 2 ; died, 0. Total, 14.

These cases may be divided as follows :

Traumatic, 11 ; non-traumatic, 3.

Traumatic Cases.—Examination before operation revealed in 5 of these patients (Cases 1, 2, 5, 8, 12) a distinct depression of the skull, the existence of which, as well as of lesions of the membranes covering the brain, was confirmed at operation. In 4 others (Cases 3, 10, 11, 14) there was apparently a slight depression found before and at the operation, and corresponding to this a slight thickening of the dura, neither of which lesions, however, were so marked as to lead us to hope that a cure would follow their removal. In Case 7, while there was no external evidence of injury to the skull, yet there was

found on the surface of the brain, directly under the cicatrix of the scalp, marked evidence of former disturbance of the blood-circulation, presumably due to the traumatism. In Case 13 the evidence of a depressed cicatrix, the result of former operations, was very distinct. At the operation a large mass of new connective tissue, probably, in part at least, produced by the irritation of a piece of rubber-tissue, was found pressing down upon the cortex.

The final result in these 9 cases was : *

Cured, 3 ; improved, 4 ; unimproved, 2.

In considering their histories it will be observed that of the 3 patients "cured," in 2 the injury had been received within a year of the time of operation, and in both the injury done to the bone had been a severe one. In the other case two years had elapsed, but the injury had evidently been less severe.

In the 6 traumatic cases who were not "cured" by operation, the injury had been received, and the epilepsy had become established many years previous to the operation. (Case 2 may be regarded as partly traumatic and partly as non-traumatic.)

Non-traumatic.—Cured, 0 ; improved, 1 ; unimproved, 2. Of these 3 patients, Case 6 was a typical case of chronic epilepsy. In another (Case 4) there was distinct evidence of a prior meningeal inflammation, which, judging from the history, had occurred five years previous to the operation. In the other (Case 11) the evidences of the lesion in the brain and its membranes were too indefinite to warrant the conclusion that an inflammatory change had produced the epilepsy. The degree of improvement in this case was less than that of any of the other patients reported in this series.

It will thus be seen that 3 patients out of 12, twenty-five per cent., have been *cured* by operation. In each of these the cause of the irritation in the cortex was found. In 2 of these it was very distinct, while in the third it was less marked, but yet perfectly appreciable. Five patients have been *improved* by operation. In four of these a well-marked lesion was found, while in the fifth no lesion was visible or tangible at the time of operation, and when discovered by the microscope, seemed rather insignificant. Four patients were *unimproved* by operation. In two of those a distinct lesion was found ; in one no lesion or cause of irritation could be

* Cases 13 and 14 are not considered in the following statistics, as sufficient time has not elapsed to permit of any just conclusion as to the final outcome.

discovered, while in the fourth the lesion was so slight that some doubt was expressed as to its existence. It will also be noted that this series of cases forms no exception to the rule that the prognosis as regards cure is much more favorable in traumatic than in non-traumatic cases. In the latter class no cures resulted; one patient only was improved, and this improvement was but slight.

CASE I. *Old Depressed Fracture. Motor Epilepsy. Cure.*

W. F., aged seven, had always been a bright and healthy child. On December 20, 1890, while passing beneath a scaffolding he was hit on the right side of the head by a brick which had fallen a distance of thirty feet. He was knocked down and appeared stunned for some minutes. After the accident he remained quiet for some days and apparently entirely recovered. Some three months later, however, he began to have convulsions, the first attack occurring in the school-room without apparent cause. The epileptic attacks became more numerous, so that in the two months before his admission to the hospital, he averaged one in three days. They generally began in his left arm, and while not always confined to the left side, the convulsive movements were generally much more marked on that side.

On admission, on June 19, 1891, he was partially stupid as the result of a fit. On the next morning, however, he appeared bright and happy. There were no paralyses. Eyes were normal. On examination of his head there was found over the right parietal bone a depressed cicatrix, and under this a depression in the bone about the size of a silver half-dollar. There was distinct tenderness on pressure on this point. He remained well until June 23, when he had a convulsion beginning in the left forearm, extending to the left leg, the muscular twitching in both these extremities being very violent, and finally the spasms extended to the right arm and leg, though on this side they were much less violent. The convulsion lasted two to three minutes, and left him stupid and drowsy for a couple of hours. It was decided to trephine over the depression, as presumably this was the point of cortical irritation which caused his epileptic attacks.

June 25. *Operation.*—Ether. The fissure of Rolando was marked on the scalp, and the cicatrix was found to cross this line near its centre. A large scalp-flap was elevated from over the

depressed bone, the greater part of which was found to be anterior to the middle point of the Rolandic fissure. With an inch trephine projecting somewhat behind the depression, a button of bone was removed. Its under-surface was roughened, depressed about an eighth of an inch, and was firmly adherent to the thickened dura. The opening was considerably enlarged by bone forceps, but no spicula of bone were found. The dura appeared thickened and opaque. It was not opened. The scalp-flap was replaced and sutured. The bone was not returned. There was but little shock, and convalescence was uneventful. The boy was out of bed at the end of ten days, and left the hospital at the end of four weeks apparently well. There had been no convulsions and no complaint of headache. After leaving the hospital he returned to school and remained free from convulsions for a period of three years. At that time he returned to the hospital for a visit to his nurse and appeared mentally and physically well. Since then he has been lost sight of, but freedom from convulsions or other bad symptoms for a period of three years seems sufficient evidence to regard the case as cured.

CASE II. *Old Depressed Fracture. Motor Epilepsy. Subacute Circumscribed Meningitis. Cure.*

Jean L., aged twenty-seven, had always been a healthy and well-balanced youth until in the summer of 1891 he fell down a flight of stairs and hit his head against the sharp edge of an umbrella-stand. He received a scalp wound and was unconscious for several minutes, and remained in a dazed condition for an hour or two. His doctor said that he had received a slight fracture of the skull, but no operation was performed. He was kept in bed for about five days, and remained in the house for a week or so longer. Soon afterward he went to work, though complaining of some headache. On the afternoon of his second day at work he felt a severe pain in his head; he lost consciousness and apparently had a mild epileptic fit. He remained away from his work for the following few days, and then resumed his post and was comparatively well for about a fortnight, when he was again seized with a convulsion. Since that he has averaged one or two convulsions a month. In spite of the administration of bromide, the attacks have recently been more frequent, and while at first the convulsive movements were confined

mainly to the left arm and leg, latterly they have been more or less general, though still always more marked on the left side. He has been carefully watched by Dr. C. J. Platt, who sent him to me for operation. Latterly, his family have noticed a slight impairment of memory and occasionally he has appeared rather irritable.

On admission, June 17, 1892, he seemed an intelligent, well-nourished man. Eyes normal. Examination of urine negative. No paralyses. On examination of his head there is seen a cicatrix over the right parietal bone, about two inches to the right of the median line. Under this there is a distinct depression of the bone involving a space about the size of a silver quarter-dollar. There is tenderness on pressure over this point.

June 20. *Operation.*—Ether. A rubber band was placed around the head and a semicircular scalp-flap reflected with the cicatrix near the centre. A line drawn on the scalp to represent the fissure of Rolando passed through the posterior part of the depression in the bone, which, after reflection of the scalp, was seen to be quite distinct. It was embraced by the crown of a trephine one and a quarter inches in diameter, and with this instrument a button of bone was removed. This was accomplished with some difficulty, as its roughened under-surface was very adherent to the dura, and after its removal the stellate projection was seen to be about one-twelfth of an inch in height. The opening in the bone was enlarged to double its original size by bone forceps. The dura was opaque and thickened. The brain-pulsation was diminished. The dura was opened by a curved incision and the flap reflected. It was found intimately adherent to the pia over a circular area an inch and a half in diameter. This latter membrane was opaque and lustreless over the same area, where there were also several large veins. They were not disturbed. Brain-pulsation now appeared normal, as did its consistency. The dura, which seemed at least double its normal thickness, was closed by interrupted silk sutures. The scalp was closed without drainage, the bone not being replaced. The operation lasted forty minutes, and but little shock followed. Three hours after return to the ward the patient had a mild convulsion, limited to the left side. His further convalescence was uneventful. Temperature reached 100° F. on the second day, and then fell to normal. Headache was not complained of. He was out of bed on July 12, and was discharged from the hospital on July 22 apparently well.

In September he resumed his position as clerk and has been well ever since. He makes no complaint of headache; has advanced in his business position, and has had no suspicion even of a convulsion or of muscular twitching. I have seen him this autumn (five years after operation) and he is perfectly well. Pulsation through the opening in the skull is scarcely noticeable on account of a very dense tissue almost as hard as bone, which has filled up the opening, and which is entirely insensitive to pressure. This case must certainly be regarded as cured.

CASE III. *Traumatism. Epilepsy, Motor and Psychical. Drainage of Lateral Ventricle. Improvement.*

Male, aged twenty-nine; florist; gives a history of occasional attacks of unconsciousness ever since he was twelve years of age. He describes them as beginning with a sudden pain in the cardiac region, followed by tumultuous beating of his heart, and ending in syncope or unconsciousness, which lasted for a few seconds and left him weak and exhausted. Convulsive movements had never been noticed. These attacks were very infrequent, sometimes two and three years intervening between them. The patient had always been of a nervous and excitable temperament. His general health had been fairly good up to the time of an accident, which occurred on October 29, 1892. On that day, while carrying a stove down-stairs, he was pushed from behind and precipitated to the foot of the stairs. He was stunned for a minute or so, but did not lose consciousness. A short time afterward, on account of the hemorrhage from a scalp wound, he was brought to the Presbyterian Hospital.

On admission, October 29, 1892, two scalp wounds were found in the occipital region, each about two inches long. There was an extravasation of blood in the left eye and hemorrhage from the left ear. He was unable to raise his left arm. For the next few days he was very stupid. He would answer questions, but unless aroused he took no notice of his surroundings. His temperature ranged between 99.5° and 100.5° F. The paralysis of the left arm gradually disappeared, and mentally he became brighter, though complaining of severe headache. By November 10 the paralysis had entirely disappeared, and though somewhat stupid and dazed, he was allowed to sit up. While sitting at the side of the bed in a chair he had a general convulsion, lasting ten minutes, followed by an apathetic

condition for a couple of hours afterward, and by slight anæsthesia of the left arm. For the following two weeks he complained of headache and dizziness, but his mental state gradually improved. He had no further convulsive movements until December 3, when a gradual convulsion occurred, lasting two minutes. It was followed by complete anæsthesia of his left arm and leg, and hyperæsthesia of the right side, and marked tenderness of the cicatrix in the right occipital region. The reflexes were absent on the left side, and exaggerated on the right side, where there was also marked ankle clonus. On the following day these symptoms still persisted, and in addition partial loss of power of his left hand was noticed and extreme sensitiveness of his right eye to light. Gradual improvement took place, and in forty-eight hours more these signs had entirely disappeared. He was still, however, stupid, and at times excitable, but on December 7 he felt well enough to leave the hospital. He remained at home for nearly a month, during which time he had two convulsions. Immediately after his second convulsion, January 4, 1893, he was brought into the medical side of the hospital in an extremely excitable and yet somewhat dazed condition. Temperature, 101° F.; pulse, 100.

January 5. A general convulsion, lasting six minutes, and again on the 11th. From January 17 to January 25 a general convulsion occurred every morning, and often a second one at night. The convulsions lasted from three to ten minutes, and were very violent. There was no regularity in the muscles which were first affected. His mental state continued to grow worse; his memory was entirely lost; at times he lay in a stupid, almost semi-comatose state, and at times was excited and delirious. He complained of a pain in the back of his head, and the slightest pressure on the occipital cicatrix caused him to cry out with pain. His temperature ranged between 99° and 100.5° F.; pulse between 85 and 100. After January 25 he became steadily worse, the convulsions became more frequent, averaging five in the twenty-four hours; his stupor increased and he became quite irrational, sometimes for an hour or so remaining in a state of semi-coma, and then again becoming very restless and noisy.

On January 28 Dr. A. H. Smith, the attending physician, felt that unless relief could be derived from operation he could not live more than a week or two, and on the next day he was trans-

ferred to my service on the surgical side. In the meantime he had been examined by a number of neurologists and surgeons, and most of their diagnoses inclined toward syphilitic gumma or general paresis. Operative interference was, in the opinion of all of them, contra-indicated. Dr. Smith, however, sent him to me in the hope that hemight be benefited. He remained under observation for three days more, during which time his symptoms remained very much the same, with the exception that his temperature ranged between 100° and 101° F., and his pulse increased in frequency (110). He was at no time rational, lying for part of the time in a semi-comatose state, and then again became excited and delirious, imagining himself persecuted and making violent efforts to get out of bed. He was very hyperæsthetic over his whole body, but especially so on the back of his head, and most markedly at the seat of the cicatrix in the right occipital region. His eyes were normal. His tendon reflexes were greatly exaggerated. As he was daily losing ground, both physically and mentally, I decided, on January 31, to do an exploratory trephining.

He was anæsthetized with chloroform, and a semicircular scalp-flap was raised, the cicatrix being in its centre. This cicatrix, which was situated just above the middle of the superior curved line of the right side, was found adherent to the bone. On exposing the bone a roughening, and what seemed to be a stellate cicatrix was found. At this point, which was just above the lateral sinus, with a one-inch trephine a button of bone was removed. The inner surface of the button was roughened, but the elevations were smooth and comparatively slight, and certainly could have produced no depression of either the dura mater or brain. The dura was found thickened and roughened over an area three-quarters of an inch square, being twice its normal thickness. By "rongeur" forceps the opening was enlarged, mainly upward and inward. A flap of dura was raised. No evidences of clot were found, and the pia mater looked normal. There was evidently, however, a great amount of intra-cranial pressure. The brain bulged out through the opening in the skull as if there was not room for it inside of the cranium. The cerebral tissue, covered by pia mater, projected through the opening in the skull half an inch beyond the external surface of the bone. Even after setting the patient upright, this bulging was still very noticeable. This extreme pressure was naturally supposed to be due

to excess of intra-cranial fluid, as no tumor or hardness could be felt on palpation of the brain-substance, which, though congested, did not appear unnatural. A hypodermic needle was thrust into the brain in three directions, but no pus or other fluid was obtained. It was then decided to tap the lateral ventricle, and for this purpose a long hypodermic needle was passed into the right lateral ventricle and about an ounce of thin, straw-colored fluid removed. The needle of the aspirating syringe was then withdrawn and a trocar and cannula thrust into the ventricle, and the cannula left for permanent drainage. About thirty minutes more were consumed before the final dressings were applied, and during this time the fluid continued to issue from the cannula at the rate of a drop every four or five seconds. It was estimated that nearly an ounce escaped in this manner. The cannula was carried out through an opening made in the middle of the flaps of dura and scalp, which were returned and sutured. The patient recovered slowly from the operation, and for the following twenty-four hours was stupid and somewhat restless. In the second twenty-four hours he was brighter, though still restless and irritable. At the end of forty-eight hours the cannula, which had been so arranged by fixation to pads of gauze that it could not slip farther out or farther in, was removed. From the amount of moisture on the pad, which absorbed all the ventricle fluid, it was estimated that between one and two ounces had escaped. This estimate, however, is unreliable, and the amount may have been much greater.

After the third day (February 3) the patient improved rapidly. There had been no signs of convulsive movements since the operation, and he remained entirely free from even twitching of the muscles during his convalescence. At the end of a week he was quite bright and cheerful, talked intelligently, asked for food, was entirely free from delirium or delusions, and had perfect control of himself. The reflexes seemed to have returned to their normal state, the hyperæsthesia had disappeared, there was no sign of paralysis, and he was able to read his bedside notes. His eyes were examined and proved normal. His memory was still defective, and he complained of occasional headache. At the end of two weeks the patient was out of bed, bright and cheerful. At the end of a month (March 1) he was apparently well, and made himself very useful in the work of the ward. His memory of events during the

past year was defective, but otherwise he seemed perfectly well. On one or two occasions, after excitement, he complained of headache, but otherwise had no pain. On March 24, after an exciting interview with some of his friends, he had some twitching of the muscles of the face and hands, but no distinct convulsion. On March 28 he went out on a pass and was brought back by ambulance in a very stupid state, evidently caused by alcohol. On April 3 he left the hospital, commenced drinking, and in the evening was carried to another hospital in a condition of semi-coma. Alcoholic intoxication was, however, evidently the cause of his mental state, as a day later he resumed work. He reported at the end of a year, and said that he had been at work for the past seven months ; that his health was perfect, and that he was bright and happy. He had no headache and no tenderness of the cicatrix. No convulsions had occurred, spite of the fact that he had been more than once intoxicated. Since that time he has averaged one epileptic seizure a year, but it has always occurred after he has been on a prolonged spree. The case can be regarded as improved.

CASE IV. *Old Non-traumatic Pachymeningitis. Motor Epilepsy and Paralysis. Sub-dural Organized Clot. Unimproved.*

Jennie A. ; aged six and a half years ; was kindly referred to me by Dr. M. A. Starr. The family history is good with the exception of the maternal grandmother, who was an epileptic. The mother reports that the child's health has been good with the exception of the fits. She states that at the age of one and a half years the child had a series of convulsions, coming on suddenly without apparent cause, and lasting several hours. As a result, there was a partial paralysis of the right arm and leg, which persisted for several weeks and then disappeared. The next convulsion occurred at the age of four years, one fit following another for two or three hours, and resulting in weakness of the right hand, a condition which lasted for a few days only. During the next six months she was perfectly well. At four and a half years there was another convulsion, without resulting paralysis, and at five years another severe convulsion, since which time she has remained partially paralyzed in her right arm and leg. For nearly a year no further convulsions occurred, though the paresis remained.

For six months previous to her entrance into the hospital (since

September, 1892) she had had what the mother calls "spasms," in which the head turned always to the right, and convulsive twitching of the right hand and occasionally of the right foot followed. For the first four months, when she was without treatment, these averaged ten in the twenty-four hours; under appropriate treatment the average number was four or five. On examination there was marked atrophy of the muscles of the right arm and forearm. She had very little use of the right upper extremity, especially of the hand. At times there was marked rigidity of the muscles of the hand and forearm, the fingers and thumb being flexed and tightly clinched in the palm. The circulation of the hand was impaired. Occasionally she could hold a large object in her right hand, but as a rule she was unable to take hold of any article. At times athetoid movements were present. There was slight atrophy of the muscles of the right leg and foot, and a distinct dropping of the toes (hemiplegic gait). Mentally the child is bright, though very bashful. Eyes normal and general nourishment good. Dr. Starr had made the diagnosis of pressure on the motor area of the right arm and leg, and advised that an opening be made in the skull over this area.

Operation.—Chloroform. The fissure of Rolando was marked on the scalp and a flap reflected. With a one-inch trephine a button of bone was removed from over the fissure of Rolando, about one and one-half to two inches to the left of the median line. On removal of the bone, the dura was found to have been adherent to its under-surface. By "rongeur" forceps the opening in the skull was enlarged downward and forward to double its original size. The dura seemed to pulsate less vigorously than usual. It was incised along the upper border of the opening and a flap turned downward. As the dura was reflected, its under-surface was seen to be rougher than normal, and lying on the top of the pia mater was seen a translucent reddish membrane. This membrane, which was about the thickness of a sheet of note-paper, covered the area of brain exposed and extended beyond. It was lifted up and removed, but there remained a border which extended beyond the opening in the skull for about three-fourths of an inch, except at its lower part. This was afterward removed by a small spoon from under the dura, the patient's head being elevated. The membrane removed was undoubtedly an organized blood-clot, and the most probable cause of the hemorrhage was a former pachymeningitis hemorrhagica.

So-called œdema of the pia was marked, the membrane being lifted off the brain by a layer of fluid nearly half an inch deep. The pia was incised between the veins in two or three places, and several drachms of fluid oozed out. As the fluid escaped it was seen that this part of the brain was depressed, as if the convolutions were atrophied. The brain on palpation appeared normal, and there was no justification for further exploration. The flap of dura was replaced and sutured, as was also the scalp-flap. The bone was not returned.

The child recovered quickly from the operation and showed very little shock. For three weeks following there was no special change for the worse or the better. The convulsions continued as before, as did the paralysis. At the expiration of six months the child had gained considerably in weight and appeared brighter, but the convulsions occurred as frequently as before the operation. A slight improvement, however, had taken place in the paralyzed muscles. The child walked with less of a limp and she could grasp objects with her paralyzed hand. This condition remained practically unchanged until the beginning of October, when the convulsions became more frequent, averaging from twelve to eighteen in the twenty-four hours. The patient was again admitted to the hospital for the purpose of inserting gold-foil between the dura and brain. The child, however, had slight fever, and in a few days it was evident that she had typhoid fever. The case was rather severe and protracted. The remarkable fact about it was, however, that from the time the disease was well established, not a single convulsion occurred. The child for three months afterward was entirely free from any convulsive movements. She had grown considerably, and the partially atrophied muscles of her right arm and leg seemed to be fuller and stronger, though a certain amount of paralysis still persisted. The convulsions, however, returned, and for a year or two afterward she was occasionally attacked by epileptic seizures. Since then she has been lost sight of, but the case may best be regarded as one unimproved by operation.

CASE V. *Traumatism. Depressed Fracture. Motor Epilepsy. Improved.*

John C., aged twenty-five. Was a perfectly healthy lad until the age of twelve, when he was hit on the side of the head by a shinny

stick. He was dazed for a few minutes but did not lose consciousness. He complained of headache for a week or so, and a few months later he had his first convulsion.

Since then his convulsions have recurred several times a month, though in the past year he has had but fifteen. They begin with an aura, a "queer feeling" in his head, he cries out and then falls in a convulsion, which appears to be more or less general. He remains unconscious for about an hour. Otherwise he seems well, though his friends have noticed that his memory is becoming impaired, and at times he shows great irritability.

On admission, on June 12, 1893, he appeared a well-nourished young fellow, with a normal pulse and temperature. On examination, a scar an inch long was seen on the right side of his head, just over the temporal ridge and two inches behind the frontal eminence. The eyes were normal, as were all the special senses. There was no paralysis. On that day he had a severe convulsion, lasting five minutes, which involved both upper and lower extremities, the eyes being turned toward the right. On June 13 he had another convulsion. It was the opinion of the nurses and other patients that at times he acted strangely and was often very forgetful.

July 17. *Operation.*—Chloroform. A semicircular scalp-flap was lowered with the scar at its centre, and beneath this was found a slight depression of the skull and a very adherent pericranium. A one-inch trephine covered the depressed area, and on removing the button of bone a slight linear prominence was seen on its under-surface. By bone forceps the opening was enlarged downward and forward. The dura under the anterior part of the opening was opaque, and evidently thickened. The brain-pulsation was scarcely noticeable. The dura was opened, a considerable amount of colorless fluid poured out (about one ounce), and the brain-pulsation then seemed normal, as did also the pia. A hollow needle was inserted into the cortex at two points, but the syringe withdrew no fluid. The dura was sutured, as was also the scalp-flap. The bone was not returned. There was no evidence of shock during or after the operation. There was a slight general convulsion as the patient was being lifted from the stretcher into his bed. With the exception of slight convulsions, his convalescence was uneventful, the temperature never rising above 100° F. The convulsions occurred on June 18, July 11, 15, and 16. He left the hospital on July 16, and since

that time has been comparatively well. In 1894 he had two convulsions; in 1895 two convulsions; in 1896 one convulsion, and none since Christmas, 1896. The attacks have always followed some great nervous excitement. He cannot be considered as cured, but he certainly has been much improved by the operation.

CASE VI. *Non-traumatic Motor Epilepsy. Unimproved.*

Louis R., aged twenty-nine, had been a bright and healthy boy until he reached the age of fifteen, when, without apparent cause, he was seized with a convulsion. His family history was good, and there was no history of traumatism. Since that time he has been a chronic epileptic. The fits at first occurred about once a month, but have been gradually increasing in frequency, and for the past year he has averaged two or three convulsions a day. They seem to be general. Lately his memory has become much impaired, and he is at times very irritable and gives way to violent outbursts of temper.

On admission, on June 22, 1893, he appeared well-nourished, but had the appearance of a chronic epileptic. At times he acted strangely, and was very forgetful. His first convulsion occurred on August 8, when he suddenly lost consciousness and had violent muscular spasms, which, however, were most marked in the right hand and arm. On August 11 and 13 he again had convulsions, and on both occasions the spasms were likewise more marked in the right upper extremity.

After consultation with Dr. Starr it was decided justifiable to make an exploratory trephining and expose the motor area on the left side of the brain.

August 17. *Operation.*—Chloroform. The fissure of Rolando was marked on the scalp, and a scalp-flap was lowered, which exposed the parietal bone over the middle and lower part of the motor area of the left side. A one and one-half inch trephine opening was made, with its centre over the fissure of Rolando. The dura, which was opened, seemed slightly thicker than usual, but otherwise no abnormality in appearance or resistance of either brain or membranes was noticed. The dura was closed by catgut. The scalp was sutured, the bone not being replaced. No shock followed the operation. The temperature did not reach 100° F., and convalescence was uneventful with the exception of an occasional convulsion. The patient remained in the hospital off and on for nearly a year,

and during this time he averaged two to three convulsions a month. There was no manifest improvement in his mental state. Since then his condition has remained unchanged. His convulsions occur as before, and the patient has derived no benefit from the operation.

CASE VII. *Traumatic Epilepsy Characterized by Psychical Attacks. Headache. Removal of Small Angioma. Loss of Muscular Sense in the Right Arm, lasting six weeks. Improved.*

S. F., aged twenty-one, is the son of healthy and intelligent parents, with a personal and family history free from any rheumatic or syphilitic taint or alcoholic habit. Up to his fifth year he was a bright and healthy child. He then had a severe fall on his head, followed by unconsciousness for twelve hours. Since that accident he never completely regained his mental balance, and has suffered from pain on the left side of his head. He seemed fairly bright at his lessons, and was willing to study, but was very easily excited and accustomed to give way, without adequate cause, to emotional impulses, either of joy or anger. When sixteen years of age he had a second fall on his head, followed again by unconsciousness for several hours. Since his second accident all his symptoms have been decidedly aggravated. The headache is located by him in the left parietal and occipital regions, and the maximum point obtained seems to be at a point half-way from the parietal boss to the median line, and at this spot a small scar can be seen, and there can be felt a slight irregularity of the surface of the skull, suggestive of a fracture. The pain from which he suffered, though continuous, was subject to exacerbations. In connection with the sudden increase of pain the boy would develop a maniacal condition, in which his actions were extravagant, his speech abusive and profane, and in which he at times indulged in acts of violence toward his family and employers. In consequence of these attacks, which occurred every few days, or, when under treatment by bromides, every three or four weeks, he was unable to keep up his classes at school or to pursue any steady employment.

He was not particularly bright or intelligent, though he could not be said in any sense to be demented. Between the attacks he had no clear recollection of what had occurred during an attack, and on several occasions he had lost consciousness; he had never had any convulsions. All remedies have failed to produce any relief

from these distressing symptoms. After consultation with Dr. Starr it was thought justifiable to trephine him at the site of the pain. It was thought that in all probability there had been a fracture of the skull at the time of the fall and a local pachymeningitis beneath the fracture, as well as some injury of the brain-substance. Very careful tests made before the operation failed to reveal any disturbance of the special senses or any disturbance of motion.

February 10, 1894. *Operation.*—Chloroform. After reflection of the scalp-flap considerable thickening of the tissues was noticed, especially of the pericranium, which was very adherent to the skull. Directly under the cicatrix was a slight linear depression upon the surface of the bone. With an inch trephine a button of bone was removed, its centre being one and one-quarter inches to the left of the median line, one and three-quarter inches behind the fissure of Rolando, and an inch above the parietal boss. There was no evidence of fracture on the inner table, and the dura mater appeared normal. The opening in the skull was enlarged by rongeur forceps. When the dura was incised and reflected there was no evidence of any internal pachymeningitis, but the surface of the brain and pia presented an abnormal appearance. A large number of veins of the pia mater appeared to be distended and increased in size, so that a vascular mass, consisting exclusively of veins, was present just under the trephine opening. This mass of veins, covering a space three-quarters of an inch in diameter, contrasted very markedly with the normal appearance of the pia at adjacent portions. The larger veins leading into this mass of vessels were tied with catgut, which was passed in a needle under the vessels, and probably at four points the superficial layer of the brain-cortex was slightly lacerated by the passage of the needle and the tying of the ligature. The brain-cortex about this mass appeared to be normal, but it was explored by the hypodermic needle with a view of the possibility of finding some cyst beneath; nothing was found. The wound was then closed. Recovery from the surgical operation was steady and progressive. He was fit to be discharged from the hospital in ten days.

Remarks by Dr. Starr.—Immediately after the operation the boy noticed a peculiar awkwardness in his right hand and arm. When examined this was found to consist of a most pronounced condition of ataxia, all finer co-ordination of movement being impossible. Thus,

any attempt to grasp a pencil or a glass of water, or to pick up a pin, resulted in most excessive motions, without the possibility of carrying out the desired movement. The attempt to place his finger upon his nose with his eyes closed failed, the finger frequently being carried up above the head or far to one side. When his eyes were closed he was absolutely unable to tell what position had been given to his fingers or hands by the examiner. He did not know whether his hands were closed or open. When his hand was placed in a position and he was requested to put the other hand in the same position, his eyes being shut, he was totally unable to do so. There was altogether a complete loss of muscular sense in the hand and wrist. At the same time his actual power was greater in the right hand than in the left. There was no disturbance whatever of tactile sense or the sensations of temperature and pain. There was no similar disturbance in the leg, and his gait was perfect. There was no affection of the face or the eyes. It was evident that the effect of the operation upon a spot in the brain about at the junction of the superior and inferior parietal convolutions, clearly posterior to the posterior central convolution, had resulted in a loss of muscular sense in the opposite hand and forearm, without any disturbance of other sensations or of the power of movement.

This condition of ataxia remained stationary for about three weeks, and then gradually subsided. On April 10, when he was last examined, no trace whatever remained, and the boy was practically well, being free from his old headache, feeling much brighter and more active, and having had no return of his attacks of epileptic nature. Since then he has been comparatively well. He has no headaches, but occasionally becomes very much excited and is at times irritable. It is fair to consider the case as one *improved* by operation.

CASE VIII. *Traumatic Recurrent Local Meningitis. Improved.*

Mary S., aged nineteen, was a perfectly healthy child until at six years she fell from a height and sustained a severe injury of her head. The skull was said to be fractured, and she was confined to bed for several months. Since that time she has never been entirely well. Up to the age of thirteen she suffered from frequent severe headaches, and at times lost consciousness for a minute or two. Between the age of thirteen and seven-

teen she seemed to improve, the improvement commencing with the appearance of menstruation. At the age of seventeen (in 1894) she was seized with "brain fever," and was confined to bed for many weeks, being unconscious for fourteen days. During this illness her muscles frequently twitched violently; she had no paralyses. She recovered, and from March, 1895, till three days before her admission to the hospital, with the exception of headaches, she was comparatively well. On March 13, she was seized with a severe headache and soon became unconscious, and remained so for twenty-four hours. During the next two days she complained of terrible headache; she vomited frequently and there was considerable muscular twitching. On March 16, she was brought to the hospital. She still complained of headache, and photophobia was marked, as was also Romberg's symptom. Temperature was 99.5° F.; pulse, 112; respiration, 28. The urine contained a trace of albumin. She was stupid and listless, at times irritable, and took but little interest in her surroundings. She complained constantly of pain in her head.

On examination of the head, a scar one inch long was seen about the centre of the head, just to the right of the median line, and beneath it was apparently a depression in the bone.

During the week, before the operation, the condition remained very much the same. She was drowsy part of the time, and at times moaned and complained of her head. There were also muscular twitchings of both extremities. There was no paralyses, neither did a distinct convulsion occur. Her temperature remained between 97.5° and 99° F., and her pulse between 80 and 90.

The diagnosis was made of local meningitis, with pressure on and irritation of the cortex. Operation was advised, and on March 24 chloroform was administered. On measurement, the cicatrix was found to be just one inch to the right of the median line, and was bisected by a line drawn on the scalp to represent the fissure of Rolando. A horseshoe scalp-flap was reflected. A slight depression was found under the scar, and to this the pericranium was very adherent. A trephine one and one-quarter inches in diameter was placed over and slightly external to the depressed area, and a button of bone removed. The dura was intimately adherent to the bone, was much thickened by the presence of new tissue, and presented a very vascular appearance, being covered by large distended veins.

Pulsation was entirely absent. By bone forceps the opening in the skull was enlarged outward.

The thickening of the dura had evidently been caused by a chronic pachymeningitis. It was opened by a crucial incision and was found very adherent to a layer of tissue which lay between it and the pia. This layer, about one-quarter of an inch in thickness, was composed of pinkish, almost jelly-like tissue, rich in blood-vessels, evidently the product of a comparatively recent inflammation. It extended beyond the limits of the opening in the skull, which was accordingly enlarged outward and backward till the limits of the meningitis seemed to be reached. This corresponded to the oval opening in the skull, about three inches in the antero-posterior direction, and two inches laterally. On elevation of the dura the brain-pulsations appeared, and after scraping from off the pia the layer of soft inflammatory tissue, the pulsations seemed normal, as did also the resistance. On the surface of the cortex were now seen a large number of dilated veins, which almost hid the cerebral tissue from view. These large veins were tied at six spots by fine catgut ligatures. A hollow needle was thrust into the cortex without result. After careful hemostasis the dura was sutured, as was also the scalp. The bone was not replaced. A drain of gauze was inserted under the flap, as there was considerable oozing of blood. The operation lasted seventy minutes. No motor symptoms were noted. Convalescence was uninterrupted. The mental state was brighter on the day after the operation and continued to improve until her discharge from the hospital. There was no further complaint of headache, and the patient seemed fairly intelligent. On April 1 there was a slight general convulsion, and she was rather stupid for half an hour afterward. There was no loss of consciousness. On April 10 she was out of bed and seemed bright and happy. The temperature had reached 100° F. on the second day, but afterward remained under 99° F.

On May 3 she appeared so well that she was allowed to leave the hospital. She walked without staggering, and appeared to be in a normal mental condition. Since then she has been practically well. She occasionally complains of headache, but since the operation has never been confined to her bed for a single day. During the past year she has not personally been examined by me, but her sister reports that she is in excellent health and able to do her work intel-

ligently. As, however, in the past she has had periods of comparative freedom from cerebral symptoms, it is, perhaps, wiser to consider the case as *improved* rather than cured.

CASE IX. *Non-traumatic Motor Epilepsy. Excision of Hand-centre. Improved.*

Bessie H., aged sixteen, admitted, November 22, 1896. Personal and family history good. She had always been a strong and sensible child. No history of traumatism. In December, 1894, she began to suffer from "spells."

She noticed that suddenly, without warning, her right arm and leg began to twitch. Since this time she has suffered more or less continuously from twitching in right hand, and occasionally in the right foot and leg, and also of the facial muscles on both sides.

Sometimes for weeks she would not twitch, and then again for weeks she would suffer from several spells every day.

In December, 1896, the attacks of twitchings were so severe that she was kept in bed for six weeks. For the four months following this she was almost free from attacks, when they again recurred as before. In August, 1896, she suffered from another series, lasting for some weeks, and again just before admission to the hospital.

Her general health had remained good. She had never lost consciousness and had never suffered from hysterical attacks, at least from any symptoms that her family or physicians considered as due to hysteria.

In November, 1896, she was admitted to the medical division by the advice of Dr. M. A. Starr, who wished her kept under observation for some weeks. After her admission she suffered from frequent spasms of a mild character, affecting the right hand and forearm and occasionally the right leg. The thumb was most affected by the spasms, it being drawn inward across the palm. Under the influence of bromide these diminished in frequency, so that for a day or so she would be almost entirely free from twitchings of any kind. As soon, however, as the drug was discontinued the spasms returned with increased frequency, so that at one time she had from one hundred to one hundred and eighty in the twenty-four hours. At first it was a question whether the spasmodic contractions were due to hysteria or epilepsy. After careful observation, however, Dr. Starr decided that the attacks were epileptic in character and

advised a trephining and exposure of the arm-centre on the left side.

On November 24 she was anæsthetized with chloroform. The thumb and wrist centres were marked out on the scalp, and with this as a centre, a bone-flap, horseshoe in shape, was cut by means of chisels. The bleeding from the bone was very free. The bone-flap was reflected and the dura exposed. It seemed normal. It was opened by a crucial incision. The pia and cortex appeared normal, but the intra-cranial pressure seemed exaggerated. The cortex was stimulated by faradic current and the thumb-centre located. This corresponded exactly with the spot which had been marked out on the scalp. As no lesion was visible, it was decided to excise the hand-centre of this side, which seemed to occupy a space on the surface of the cortex about three-quarters of an inch square. Accordingly a portion of the cortex, about one inch square and three-quarters of an inch in depth, was excised. The hemorrhage which followed was slight. The dura was sutured and the bone-flap replaced. There was considerable shock during and after the operation, but the patient rallied quickly.

On November 26 there was some slight twitching of the hand, but with this exception she seemed perfectly well until December 13, when she had a general convulsion, and during the next ten days several others; otherwise her convalescence was uninterrupted, the wound healing by primary intention. She remained in the hospital as a servant for the following two months, and during this time, with the exception of two general convulsions, she seemed perfectly well. The spasms had apparently entirely disappeared. There was no paralysis or weakness of the muscles of the hand or arm following the operation.

The microscopical report by Dr. Thacher is as follows: "In the cortex a few areas where the small cells are rather crowded, some of them appearing to be leucocytes. In the membranes hemorrhages; some small vessels contain many leucocytes."

She returned to her home in the country in the beginning of April, and with the exception of two or three convulsions during the early summer, her father reported that she seemed perfectly well. She could not, however, use her right hand with precision. Her last convulsion occurred in July. On December 10 she returned to the hospital for observation. She seemed to be in robust

health, and appeared bright and happy. The bone-flap had united perfectly, though it was somewhat elevated above the rest of the cranial vault. Movements of the thumb and fingers of the right hand were impaired. There did not seem to be a loss of power, but rather an inability to properly co-ordinate her movements. There was also a tendency on the part of the thumb to flex itself over the palm of the hand. There appeared to be no distinct muscular spasms, though there was a tendency to tremor of the thumb when it was kept under observation. The improvement in her general mental state was pronounced, though perhaps her gain of more than a year in age might explain this. Her father, however, was very positive that she had been improved in every respect by the operation. He hoped by another operation the complete use of the right hand might be regained, but on consultation with Dr. Starr we decided to defer any further operative interference for at least another year, and in the meantime to consider the case as one *improved* by operation.

CASE X. *Traumatic Epilepsy, Motor and Psychological. Unimproved.*

Charles P., aged thirty-three. A moderate drinker, without history of syphilis. He had always been well until eight years ago, when he was caught in a machine-shaft and carried around the wheel for several revolutions, and when finally thrown off, struck against a heavy beam. He was picked up unconscious, in which state he remained for five or ten minutes. He received a small scalp wound, but his physician said that there was no sign of fracture of the skull. He was confined to bed and to the house for several weeks, and suffered from severe headache. He soon returned to work and was comparatively well until two years ago (January 18, 1894), when he noticed some weakness of his legs. In July, 1894, he fell over a chair and received a lacerated wound of the penis, which bled profusely. On the following day he lost consciousness for a few seconds, and on recovering his senses felt a severe headache. A few minutes later a convulsion occurred, which was followed by a series of others, short in duration but quite violent, in which his whole body twitched. He appeared well for a month, and then in August he had another series of convulsions, and another in September, and again in December. During the month before his admission the fits had

been much more violent and more frequent, sometimes there being as many as forty in twenty-four hours. They were preceded by an ache in the back of his head, a dimness before his eyes, and then, suddenly, spasmodic contractions of his muscles occurred. The convulsions involved all his muscles and were very violent. He would spring out of bed, smash furniture, and try to jump out of the window. At times he was very noisy and maniacal for a few seconds. Between the attacks he felt fairly well, except that his legs occasionally gave way under him.

By the advice of Dr. Starr he came to the hospital for operation. On admission, January 14, 1897, his temperature was 98.5° F.; pulse, 84; respiration, 24. He seemed irritable and at times surly. On January 15 he had a series of violent convulsions. It began with clonic spasms in his right leg and hand, rapidly passing into a general tonic spasm, his head being thrown back, his muscles all rigid, and his body in a state of opisthotonus. This was followed by very violent muscular spasms of his whole body and an occasional yell. The movements were very violent, and with two orderlies and a nurse trying to restrain them he dragged all three over a large space on the floor of the ward. The convulsion lasted about two minutes, and then for several minutes his mind was apparently clear, when he had another convulsion of the same character, and so on until six had occurred. For some hours afterward he was dazed and weak, but again in the evening he had another violent convulsion. On January 16 he seemed all right, but on the 17th and again on the 19th he had another series of convulsions. On examination of his head a cicatrix was found in the left occipital region near the parietal suture, and beneath this there seemed to be a slight depression of bone. It was decided to perform an exploratory trephining in order to expose the brain under the apparent depression.

On January 21, after a hypodermic injection of one-quarter of a grain of morphine, chloroform was administered. A large horseshoe incision was made in the scalp, enclosing the motor area of the left side and part of the occipital bone and also the cicatrix. Under this was found a small linear irregularity and depression in the bone near the junction of the left parietal and occipital bones.

A button of bone one and one-quarter inches in diameter, with the depression near the centre, was removed. The bone at this point was much thickened and sclerosed. It was as hard and as solid as

ivory. The opening was enlarged toward the median line by bone forceps until normal bone tissue was found, the opening being somewhat circular in shape, about two and one-half inches in diameter. The dura appeared somewhat thickened, but was not abnormally adherent to the bone. It was opened by a cross incision. There were no adhesions to the pia, which appeared œdematous. The brain was of normal appearance and consistency. As there was no indication of any cortical lesion, the dura was closed by suture, as was also the scalp. The bone was not replaced.

No sign of shock followed the operation. The maximum temperature was 99.5° F. and pulse 88 on the second day. On January 28 there was some twitching of the face and right fingers, but apart from this there were no convulsions and his mind appeared perfectly clear. He was discharged on February 6. After leaving the hospital he seemed to be well, and in spite of warnings he went to work and remained free from bad symptoms until February 14, when he became dizzy while walking in the street. He hurried home, and just as he was entering his house he had a severe convulsion, followed on the next day by several others. The convulsions were even more violent than before the operation, and they were accompanied by great psychical excitement. He returned to the hospital on February 17. During the next few days he had several violent seizures in spite of bromide. Under the influence of this drug he became milder, and for some days before he again left the hospital he was free from spasms. He returned home on March 18. After his return home his convulsions returned, and though no trace of him can be found, it is fair to presume that he has not been benefited by the operation. The case is regarded, therefore, as *unimproved*.

CASE XI. *Traumatic. Old Fracture. Psychical Epilepsy. Cured.*

H. C. J., aged thirty-one, admitted January 17, 1896. A man of temperate habits, without history of syphilis, and who had always been strong and well until two years before admission, when he fell a distance of twenty-five feet, striking on the back of his head and shoulders. He was unconscious for nearly an hour, and for a week or so afterward suffered from severe headache. At the end of three weeks, however, he returned to his work as a car-

penter. About a month later, while at work, he experienced a sudden severe headache, beginning in the back of his head and becoming general. This continued all evening, but by next morning had disappeared, and for the next month he felt perfectly well, when he was seized with another violent headache, which lasted for several hours. Since then the headaches have come more frequently and have been more severe. During the past six months he has had one or two severe headaches every week, and sometimes they would persist for several days, and recently he has suffered almost continuously from a very severe headache. His friends say that latterly he has at times been irrational, and that he appears listless and stupid. He takes no interest in his surroundings, and his memory is impaired. He often acts as if demented. There have been no convulsions. Occasionally he has apparently lost consciousness for a few moments.

On admission, temperature was 99.2° F. ; pulse, 78 ; respiration, 20. On examination a small scar was seen just above and to the right of the external occipital protuberance. Beneath this was felt apparently a small depression in the bone. The eyes were normal. There was no sign of paralysis.

January 21. *Operation*.—Chloroform anæsthesia, preceded by hypodermic injection of one-quarter of a grain of morphia. A large horseshoe incision was made, beginning just behind and above the right ear and carried up to the median line and then downward over the occipital. The flap when raised exposed the right half of the occipital and posterior part of the right parietal regions. There was a slight irregularity of the bone under the cicatrix, but no depression. At this point a one-inch button of bone was removed by a trephine, this being just above and one inch to the right of the external occipital protuberance. The opening was enlarged by bone forceps forward and upward. The dura was not abnormally adherent to the bone, but it was markedly opaque and considerably thickened. It was opened by a crucial incision. The pia and brain appeared normal. As no further exploration seemed justifiable, the dura was closed by catgut sutures, as was also the scalp. The bone was not replaced.

He convalesced rapidly and uneventfully, and was out of bed on January 29, and was discharged on February 5 apparently well. His friends report that he has appeared perfectly well in every respect

since his departure from the hospital, and he writes on December 8, 1897: "I have had no headache whatever like what I had before the operation. The place on my head has not filled out very much; it is quite sensitive if I hit it. I sometimes have a severe pain across my eyes. I am feeling very well." The case is regarded as *cured*.

CASE XII. *Mastoid Trephining. Motor Epilepsy. Unimproved. Second Operation Insertion Rubber Tissue and Celluloid Plate.*

Edward M., aged eleven, was admitted to the Presbyterian Hospital on February 23, 1897. At the age of twenty-two months he had suffered from a right otitis media with perforation of the drum membrane, followed by a mastoiditis, for which an operation was done. Immediately after the operation the mother noticed a loss of power in the left arm and leg. The ear was cured and the child was apparently well for a period of eighteen months. At the age of three and a half he began to be feverish and restless and would wake out of his sleep with a sharp cry. Soon afterward he had several epileptiform convulsions, limited chiefly to the left side, and occurring almost daily. On one or two occasions there were also convulsive movements of the right arm. In October, 1894, the skull was trephined over the right motor area, and after that operation the fits disappeared and did not recur till July, 1896, since which time he has had from one to three convulsions daily. The convulsions are followed by drowsiness, which lasts for several hours.

On admission the boy appears fairly well nourished, and seems to possess ordinary intelligence. A depressed area is seen behind the right ear, and another in the right parietal region, beneath which is felt a circular opening in the skull, within which the scar is evidently adherent to the intra-cranial structures. There is marked paralysis of the extensor muscles of the left forearm, with some atrophy and wrist drop. The left ankle shows some rigidity, and there is partial paralysis of the extensors of the foot. Reflexes are normal, as are also the eyes.

On February 25, he had a convulsion, characterized by violent jerking of the arms, especially the left; it was followed by unconsciousness, which lasted for three minutes, and drowsiness for several hours. In other respects the boy seemed perfectly well, and was bright and happy.

Operation was deemed advisable, inasmuch as there was evidently cortical irritation of the motor area, due to the depressed and adherent scar. It was thought that by an operation this could be relieved, and that, perhaps, some additional focus of irritation might be revealed. The old trephine opening was situated directly over the centre of the fissure of Rolando. On March 2, chloroform was administered, and a semicircular skin-flap, with the trephine opening in its centre, was carefully dissected from the edge of the opening and from the dura, to which it was firmly fastened by connective tissue. The opening in the skull was circular in shape, about one and a half inches in diameter, and its edges had been beautifully smoothed and bevelled by nature. A layer of connective tissue one-sixteenth of an inch in thickness was dissected from the surface of the dura and removed. The dura was then seen to be much thickened (one-eighth to one-quarter inch), and near the centre of the opening was seen a cyst which contained about ten drops of clear straw-colored fluid. A cross incision was made and the flaps raised from the pia, to which the dura was adherent. This latter membrane was much thickened, opaque, and deœmatous. The brain-pulsation, which before had not been noticeable, now appeared. The thickened dura was cut around the edges of the opening in the skull and removed. The hemorrhage had been but slight, and after a few minutes pressure seemed to be controlled. To replace the dura, which had been cut away, a circle of rubber tissue somewhat larger than the trephine opening was inserted on the pia under the skull. Over the trephine opening and projecting somewhat beyond its edges was placed a sheet of celluloid one one-hundredth of an inch in thickness, and over this the scalp-flap was sutured in place. The shock of the operation was very slight, and the boy returned to the ward in excellent condition.

On the three following days one or more convulsions occurred each day. On March 5, as there seemed to be an accumulation of fluid under the celluloid plate, the wound was partially reopened and an ounce of bloody serum allowed to escape. The rubber tissue seemed rough and crumpled, and was withdrawn, as was also the celluloid plate. A drain of rubber tissue was inserted and the scalp resutured. During the following fortnight three convulsions occurred. There was no noticeable rise of temperature at any time. On March 23, the boy was taken home. Since then the convulsions

have occurred almost as frequently as before the last operation, and the paralysis remains unchanged. The case may be regarded as one *unimproved* by operation.

As the father was anxious that another attempt should be made to cure the boy, on January 9, 1898, chloroform was administered. The scalp-flap was again reflected. It was found very adherent to the connective tissue, which had again formed in the trephine opening. This was dissected out of the opening, and was found to be a layer about one-eighth of an inch in thickness, from the under-surface of which bands passed down into the cortical substance, to which the connective tissue had been adherent. The brain convolutions under the trephine opening were markedly atrophied, a space of an inch intervening between the surface of the brain and the skull. The sensation given to the finger on palpation of the brain immediately under and adjoining the trephine opening was unnatural, caused by an increase in the connective tissue and an atrophy of the brain-structure proper. Some bleeding was caused by snipping away the bands of fibrous tissue. By a few catgut sutures and by gauze pressure it was readily controlled. The gauze pressure was continued for ten or twelve minutes. A patch of rubber tissue was placed upon the surface of the brain, its edges projecting slightly beyond the edges of the opening in the skull. Over this opening was placed a circular plate of celluloid one one-hundredth of an inch in thickness, and projecting about one-third of an inch on the external surface of the skull. The scalp was sutured; no drainage. There was no shock, but during the night the boy had several severe convulsions. His mental condition, however, was much benefited by the operation, and since he has had but one convulsion, and that of mild type. Two months have now elapsed, and the improvement in his general condition is very noticeable. The cicatrix is healthy. Brain-pulsations cannot be felt.

CASE XIII. *Old Depressed Fracture. Trephining. Motor Epilepsy. Insertion of Rubber Tissue at Later Operation. Recurrence of Epilepsy. Dense Cicatrix in Cortex. Platinum-foil.*

Walter N., aged seventeen, had been a bright and healthy boy until August 5, 1892, when he fell, striking his head on a stone pavement. For a short time he was unconscious. A few hours after the accident he was brought to the hospital by ambulance.

On examination there was found a slight abrasion in the left frontal region. There was partial paralysis of the right arm and leg, also strabismus. His mind seemed clear. As the palsy persisted and seemed to be increasing, an incision was made by the house-surgeon over the anterior parietal region of the left side. A linear fracture was found running forward, which, when followed, was found to end in a depression of the skull, the depressed portion, about the size of a silver half-dollar, being situated one inch above the left eye. The depressed bone was elevated and removed. Stellate lines of fracture ran outward in several directions. On the following morning the paralysis had disappeared. Recovery was uninterrupted, and the boy was discharged on September 3. He remained well for eighteen months, when he began to have convulsions, and these continued, averaging two or three a month. They were general, but the head was always turned to the right. They were followed by stupor. In the intervals, with the exception of occasional headaches, he was comparatively well. The convulsions persisted, and about two years ago he was operated upon in a hospital in this city. A cicatrix was dissected from the dura, and over this membrane, inside the opening in the skull and under its edge, was inserted a piece of rubber tissue. After this operation he was well for twenty months. In November, 1897, he began to "feel queer." He experienced peculiar sensations, and at times acted in a dazed manner. On January 30, 1898, he was seized by a severe convulsion, and this was followed by a series of fits, which continued at intervals of every half-hour until he was admitted to the Presbyterian Hospital, on February 2. His convulsions were then almost constant, and between the fits he remained in a semi-comatose state, the pulse averaging 120, and temperature 104° F. The convulsions were general, and during the first eight hours after his admission they numbered ten, after which time, as the result of bromide and stimulation, their frequency became much reduced, so that between February 4 and 8 they averaged one in the twenty-four hours. During these four days his mind was comparatively clear, but he was very forgetful and excitable, but never irritable. There were no paralyses, and his eyes were normal. A small superficial ulcer was present in the cicatrix over opening in the skull, which was felt almost directly above the left eye.

February 8. *Operation.*—Chloroform. A semicircular scalp-

flap was reflected downward, exposing the opening in the skull, which was found filled with dense connective tissue, to which the scalp had been firmly adherent. The opening was circular, one and one-half inches in diameter, its linear border one inch above the left supra-orbital arch. A layer of connective tissue one-sixteenth of an inch in diameter was dissected from this opening. Underneath, there was found more connective tissue, very dense except near the middle, where a softer mass was seen, looking like old granulation tissue, in which were mixed scraps of a blackish substance. These were afterward found to be bits of rubber tissue which had become agglutinated with the soft connective tissue into a mass the size of a cherry. This was continuous underneath with more dense connective tissue which dipped down into the third frontal convolution. The entire mass of cicatrix (fibrous tissue) removed was about the size of a small walnut, and after its removal a cavity remained in the cerebral substance one and one-half inches long, one inch wide, and one inch in depth. The cicatricial mass had been cut out by scissors, and considerable bleeding followed. It was easily controlled as long as pressure was maintained, but on the removal of the sponge, at the end of ten minutes, it had not permanently ceased. It was therefore deemed wise to insert gauze packing, and accordingly this was done, the surface of the brain being first covered by rubber tissue to prevent the gauze from adhering to the cerebral surface. The scalp was sutured over another layer of rubber tissue. No evidence of shock followed, and on the following day the patient was bright and felt happier, he said, than he had been for weeks previous to the operation. Forty-eight hours later the scalp-flap was retracted for the purpose of removing the packing and inserting on the surface of the brain under the skull a permanent layer of some metallic foil. The cavity in the brain had almost disappeared, and there was seen but a slight depression. Its surface, however, looked somewhat ragged and unhealthy, and it was therefore thought best not to insert a permanent plate. A layer of rubber tissue was accordingly placed over the brain and its end brought out through an opening in the scalp-flap, which was again sutured in place. The dressing was not changed until five days later, when the scalp was again reflected. It was then seen that during the past five days the brain had bulged slightly through the opening in the skull. Its surface was smooth and was covered by a thin layer of fibrin. It had

been intended to insert on the surface of the brain, under the skull, a plate of thin platinum-foil. On account of the projection, however, of the cortex, this was found impossible, and accordingly the platinum plate was placed on the exterior of the skull, instead of under its internal surface. The scalp was resutured. Convalescence was rapid and gratifying. There have been no convulsions. There was progressive improvement in the mental condition of the patient. At the end of a month his mind is perfectly clear, his excitability has almost entirely subsided, and his memory is good. The wound is healed. Brain-pulsation can be felt through the plate.

CASE XIV. *Old Depressed Fracture. Motor Epilepsy. Trephining. Insertion of Celluloid Plate.*

Wm. P., aged twenty-three, had been a bright and healthy boy until the age of eight, when he fell downstairs and struck on his head. He received a scalp wound of the forehead, but his doctor said that the skull was not fractured. He was comparatively well for two years following, when he began to have convulsions. For eight years the fits were mild, but very frequent, often as many as four or five a day. Latterly they have been more severe, but less frequent. Sometimes a month or two of freedom will intervene between the attacks, and again several may occur in the twenty-four hours. At times he becomes unconscious and remains in a stupid condition for an hour or two after the convulsion. At other times—and this has especially been the case in the last six months—there is no loss of consciousness and no resulting drowsiness. The convulsions, according to his own and his friends' account, have been more or less general, though the muscular twitching has been invariably most marked in the right hand. During the past year or two he has been very irritable, and is gradually losing his memory. On the advice of Dr. A.-A. Smith he came to me for operation, and entered the Presbyterian Hospital on January 28, 1898. He remained under observation for five days, and during this time had two convulsions. One was carefully observed by the nurse. The patient was standing, when suddenly his whole body became more or less rigid, and he would have fallen had not the nurse caught him. When she reached him, his right fingers were flexed and rigid, and his thumb was in a state of tonic contraction across the palm of his hand. His left hand

was relaxed. The fit continued one to two minutes, there were some slight general clonic contractions, but his right hand was decidedly more affected than any other part of his body. There was no cry and no loss of consciousness. The fit was not followed by drowsiness.

On examination, there was found in the centre of the forehead, about two inches above the root of the nose, a cicatrix, and beneath this a slight depression of the bone, situated in the middle line. The depressed portion appeared to be about half an inch in diameter.

Operation. March 1.—Chloroform. A T-shaped incision exposed the depression in the bone. The surface was roughened and the pericranium was very adherent. With a one-inch trephine a button of bone was removed, including the depressed area. No depression of the internal table was recognized. The dura was slightly injected and possibly thickened over the longitudinal sinus. Brain-pulsations appeared normal. The dura was opened by a crucial incision. The brain on inspection appeared normal, but on palpation there seemed to be less resistance than usual. A fine hypodermic needle was inserted into the cortex at two points, but fluid was not withdrawn. The dura was sutured with catgut. A plate of celluloid was placed over the opening, projecting slightly beyond its borders. The scalp was sutured. No shock followed. The patient was out of bed on the third day, and experienced no pain or discomfort. Primary union resulted. He left the hospital on March 19 and since then there has been a distinct improvement in his mental state, but he has had two mild convulsions.

XXVII.

A RARE CASE OF SEPTICÆMIA—DIFFUSE SUPPURATION OF THE CHEST-WALL.

BY W. GILMAN THOMPSON, M.D.

FOLLOWING are the notes of a case of unusual interest as illustrating the difficulty often experienced in diagnosis of obscure sepsis and of discovering its origin.

The patient, a German male laborer, aged fifty-six, was admitted to the Presbyterian Hospital, where he died after an illness of nine days. He was not under the influence of alcohol at the time, but acknowledged free indulgence in spirits. His previous health, excepting one or two attacks of rheumatism, had been excellent, and, until within two days of his admission to the hospital, he had been at work at a restaurant in Harlem where he was employed. He was suddenly taken ill, having several chills, severe pain in the back, and frontal headache. Upon admission, he complained of these symptoms, together with great prostration, restlessness, and some tenderness over the lumbar region. The temperature was 103° F.; pulse, 110; respiration, 24. The urine contained about fifty per cent. (bulk) of albumin, with granular but no pus casts. Physical examination showed a remarkably well-developed physique, with good color and no appearance of anæmia or of sepsis. A few vague spots of subcutaneous ecchymosis were observed over the left chest-wall anteriorly and over the left scapula. On being closely questioned, the patient made an indefinite statement about having been struck over the chest with some sort of club a few days previously, but, as he was not much hurt at the time, he had not attributed his illness to the injury. Most careful and repeated examination failed to disclose any local abrasion of the surface, or any sign of localized pus accumulation. The face was suffused, and the conjunctivæ were congested. The heart was found normal. The left lung gave signs of commencing tuberculosis over a small area at the apex; otherwise

the lungs appeared normal. The liver was enlarged downward to an inch below the free border of the ribs. The spleen did not appear enlarged. The abdomen was somewhat pendulous with fat. The man appeared so ill with the prominent symptoms of fever—severe pains in the head and back, marked prostration, conjunctival congestion, etc.—that I deemed it best to isolate him, there being no apparent explanation of the symptoms, and there being some few cases of typhus fever in the city at the time. Two members of the Health Board, who saw the patient with me, concurred in the desirability of this precaution. As no eruption developed, however, I subsequently moved the patient to the general ward. Meanwhile he went on from bad to worse. The temperature rose to 105° F., the man became actively delirious, and gave evidence of severe, continued headache.

The temperature continued between 102–105° F. ; slight jaundice appeared, and there were signs of congestion at the base of the right lung. Emaciation progressed rapidly. There were no chills or sweating. The patient became more and more asthenic, and died upon the seventh day after admission, or the ninth day of his illness. At no time were there any signs of abscess or of diffuse suppuration. The chest-wall was neither tender, swollen, nor œdematous; yet the autopsy showed the curious condition of abundant, diffuse, purulent infiltration of all the muscular tissue of the entire upper two-thirds of the left chest, extending from the sternum around into the axilla, and posteriorly to the spinal column. The heart-valves were normal, the left ventricular wall was slightly thickened, and the first portion of the aorta showed slight atheromatous change. At the apex of the left lung were numerous pleural adhesions, some small caseous nodules, with much cicatrization of the lung, and a cavity about one-half inch in diameter filled with muco-purulent contents. The lung was congested and some of the bronchi contained fibrous exudation. The right lung also showed adhesions and congestion at the base, with slight cicatrization at the apex. The spleen and liver were somewhat enlarged, and the latter was granular. The kidneys appeared normal, excepting moderate adherence of the capsules and slight opacity of the cortices. Pancreas and suprarenal capsules normal. Brain normal, but pia congested. Alimentary canal normal in appearance throughout. Larynx and trachea deeply congested.

The interest of the case centres in the purulent exudate in the muscles of the left chest. The pus could be pressed out in considerable quantity, yet during life there were no abnormal physical signs obtainable over this region. There was neither excessive tenderness, pain, swelling, nor œdema. The normal appearance of the subcutaneous tissue and of the skin (excepting the slight discoloration mentioned above) makes it seem improbable that infection could have entered from this direction. The only pus focus discoverable, aside from the chest-muscles, was in the small cavity in the lung. It is possible, although it seems highly improbable, that infection was communicated from this source to muscles the vitality of which had been reduced by bruising. The patient unquestionably died from septicæmia, and after an acute illness of only nine days, although the total quantity of pus diffused through the muscles could not have been very large. The patient's life might, perhaps, have been saved by operation had there been any suspicion of the condition existing in the muscles; yet the pus was so widely diffused that it would have been almost impossible to have reached it all, and repeated careful examination of the thorax failed to give the slightest indication of its presence.

XXVIII.

SOME CASES OF PANCREATIC HEMORRHAGE, PANCREATITIS WITH FAT-NECROSIS, AND RE- TROPERITONEAL SUPPURATION OF UNKNOWN ORIGIN.

BY GEORGE A. TUTTLE, M.D.

THE retroperitoneal lesions, hemorrhage, suppuration, and gangrene, originating in the substance of the pancreas or in its immediate environment, have, in the last ten years, received an ever-increasing share of attention. The etiology of these lesions, notwithstanding most careful investigation, remains obscure. This is due largely to the extensive destruction of tissue which generally results, so that the exact starting-point of the disease cannot be determined. The pancreas is commonly considered to be the seat of the primary lesion and most of the cases are reported as pancreatitis, either hemorrhagic, or suppurative, or gangrenous, or associated with retroperitoneal fat-necrosis. Whether all of these disease processes originate in the pancreas itself, seems to be still an open question which requires further careful investigation to decide.

The interest in these diseases, until recently, has been mostly pathological, on account of their almost invariably fatal termination, and because in only a very small percentage of the cases has the condition been recognized during life. But the fact that cases of spontaneous recovery have been reported, and that more recently, in one case at least of acute pancreatitis, para pancreatic abscess, and disseminated fat-necrosis, a correct diagnosis was made and a cure effected by surgical operation, gives to these diseases an added interest and importance.

The difficulties in the way of diagnosis of these affections are

great. The cases are of rare occurrence, and it is safe to say that a majority of physicians never see one. It is therefore important that such cases as occur and are confirmed by operation or by autopsy should be reported, to contribute to the general knowledge of these diseases and keep them fresh in mind. It is with this object in view, rather than the pathology of these lesions, that the writer has undertaken to report such cases as have been observed in recent years in the Presbyterian Hospital.

Among the cases detailed below is one of simple pancreatic hemorrhage of unknown origin. The causes of hemorrhage into and around the pancreas are to be sought for in the conditions in general which lead to hemorrhage in other parts and tissues of the body. In any given case the bleeding-point or points can be demonstrated only exceptionally. Some of the conditions in which hemorrhage may occur in this region are the following: 1. Traumatism. A number of instances of pancreatic hemorrhage following injury are recorded. 2. Diseases of the blood-vessels themselves, as atheroma and endarteritis, leading to aneurism and thrombosis. 3. Diseases affecting the arteries from without, as carcinoma, cysts, fat-necrosis, and self-digestion (?) of the pancreas following disease or injury. Ponfick in 1892 said that fat-necrosis around and within the pancreas merits a great, and, up to this time, underestimated importance. Especially are many cases of hematoma of the pancreas to be referred to such a necrosis, and it is probable, further, that the pancreatic cysts, recently many times observed, whose origin has been entirely unknown, are in many cases the result of fat-necrosis. 4. General diseases which are often accompanied with hemorrhagic tendencies, as purpura hemorrhagica, scurvy, pernicious anæmia, and some cases of the acute infectious diseases. Poisoning by phosphorus may be included here. 5. Conditions which produce great mechanical obstruction of the circulation, as valvular disease of the heart, cirrhosis of the liver, etc. Hemorrhage into the pancreas has been discovered after death by hanging, by morphine poisoning, and by hemorrhage from a wound of the thigh. 6. Acute inflammation of the pancreas. Acute pancreatitis as the undoubted cause of hemorrhage has not been so clearly demonstrated as might be wished. Acute inflammation of the pancreas without hemorrhage or without suppuration possibly can occur, but it is extremely rare and very little is known about it.

The cases described by Fitz as hemorrhagic pancreatitis do not seem to be clearly demonstrated as such. The classification of certain cases as pancreatic hemorrhage, and of certain other similar cases as hemorrhagic pancreatitis, does not appear to be warranted by the evidence, and in some instances seems to be altogether arbitrary. The appearances described as due to inflammation may be the result rather than the cause of the hemorrhage, and the average earlier fatal termination in the set of cases classified as hemorrhage may be due to the rapidity of the hemorrhage as well as to other causes which are to be sought for in the general condition of the patient. The evidence thus far presented justifies the conclusion that, admitting the possibility of acute pancreatitis as the cause of hemorrhage, it is probably even more rare than the comparatively few cases recorded as such would indicate.

Hemorrhage in this region is more frequent during middle life, though it occurs in young adults also and in the aged. Childhood and youth appear to be exempt—a significant and important fact in its relation to the pathology of pancreatic hemorrhage. It occurs in both sexes, but is somewhat more frequent in males. The onset of the symptoms is sudden. While in the enjoyment of apparently good health the patient is suddenly seized with intense pain in the epigastric region and with vomiting, and soon passes into collapse, which terminates, sometimes within an hour and sometimes not until after several days, in death. The order of the symptoms is not invariable. In some instances vomiting may be the first symptom. Fever may or may not be present. The early fatal termination of most of these cases is difficult to explain, unless, as has been suggested, the close proximity of the solar plexus and the disturbances produced by the hemorrhage in this important ganglionic centre may account for it. The amount of hemorrhage is sometimes moderate and confined mostly to the pancreas. Again, it may infiltrate or break up the surrounding tissues, and in some cases it may be so abundant as to break through and pour into the peritoneal cavity. Appearances sometimes accidentally discovered in the pancreas after death from other diseases, would seem to indicate that possibly slight hemorrhage into the pancreas may occur without serious result. Two such cases have been observed at the Presbyterian Hospital, in which a pigmented cicatricial area in the pancreas showed under the microscope a quantity of rather dense connective tissue

without glandular elements, and scattered through it numerous granules and masses of yellowish and brownish pigment.

The history of the case of pancreatic hemorrhage given below is unfortunately incomplete. The autopsy was not conducted by the regular pathologist, and there is no record of any microscopical examination of the pancreas or of the other organs. The fact, however, that the liver weighed one hundred and five ounces, and was friable, yellow, and fatty, indicates that the general condition was far from normal, and that fatty degeneration of other organs as well as arterial changes were probably present.

CASE I. *Pancreatic Hemorrhage.*

P. F., male; aged thirty; laborer; was admitted to the hospital June 27, 1894, and died four and three-quarter hours later.

Previous history not obtained, except that he had not suffered any severe injury.

Present Illness.—The patient was perfectly well until three days ago. He then began to vomit, and continued to do so constantly for two days. The bowels had been constipated. Yesterday he started to go to work, but was suddenly taken with severe pain in the epigastrium. This continued all day.

On admission.—The patient complains of pain in the abdomen and of dyspnoea, and is exceedingly thirsty. Temperature, 102° F.; pulse cannot be counted; respiration, 36.

Physical Examination.—The patient is very anæmic and livid. He is conscious and is extremely restless. The tongue is dry and coated. The skin is cold and clammy. The pupils are normal. *Lungs.* Normal. Respiration rapid and labored. *Heart.* The sounds are feeble. There are no murmurs and no increase in cardiac dulness. *Spleen.* Not made out. *Abdomen.* Distended and tympanitic, except in the upper part of the right side, where it is dull and slightly tender to pressure.

Although active stimulation was employed, the patient became more and more cyanosed, and died at the end of four and three-quarter hours.

Autopsy, eleven hours after death, by one of the house-staff. Frame large and powerful; adipose abundant; muscular condition good. The *pericardium* and the muscle and valves of the heart are normal. The *lungs* are congested; the pleuræ are normal. The

peritoneum contains about a pint of bloody fluid. *Gall-bladder*. Distended with thick greenish-black bile. *Liver*. Friable, yellow, and fatty. Weight, one hundred and five ounces. *Spleen*. Soft. *Pancreas*. Infiltrated with blood and disorganized. The retroperitoneal tissue from the diaphragm to the pelvis is infiltrated with blood. *Kidneys*. Capsule free ; surface smooth ; consistence fairly firm. The cortex is thin and pale and a little opaque, and the striations are indistinct.

In a case of suicide by carbolic-acid poisoning, in addition to tuberculosis of the lungs, nephritis, and cardiac hypertrophy, the pancreas was found to be markedly cirrhotic. Under the microscope it showed abundant connective-tissue formation between the lobules, some sections containing only connective tissue. Numerous cells, generally round, but some fragmentary or irregular, are scattered through this tissue, and in places form masses like minute beginning abscesses. In some parts a few small gland alveoli are seen in large masses of connective tissue. In places, also, granules and masses of yellowish-brown pigment are found, showing that small hemorrhages had probably occurred in different parts of the gland. No recent extravasation of blood was noted. There was nothing in the appearances of the sections to suggest tuberculosis or malignant new growth.

Six cases showing disseminated fat-necrosis, more or less intimately associated with the pancreas, are recorded here. In some of these cases the areas of necrosis were confined to the superficial and interlobular fat of the pancreas itself, while in others there were, in addition, necrotic areas scattered throughout the mesentery and sometimes through the omentum and appendices epiploicæ. In the microscopical examination of sections of the pancreas a minute area of necrosis of the interlobular fat is not very infrequently found ; but the cases in which these areas are sufficiently large and numerous to constitute an important lesion in themselves are not so common. The distribution of these areas of fat-necrosis is so constantly confined to the region of the pancreas and to the retroperitoneal fat, that some lesion of the pancreas is thought to be the cause of them, and many attempts have been made to prove this experimentally. That such a necrosis of the fat, however, may rarely be more widely distributed, the case of Ponfick, who first described this lesion,

is an example. In this case the areas of fat-necrosis were found in the medullary substance of the bones. A few other cases also have been reported in which a similar necrosis of the fat has been found in other parts of the body. A peculiar degeneration of the fat, generally described as mucoid, is not infrequently met with in conditions of extreme emaciation. But the disseminated necrosis beneath and behind the peritoneum generally occurs when the fat in these situations is abundant. The gross appearance of the pancreas in these cases is often reported as normal, but the microscope often detects some lesion either in the interstitial connective tissue or in the arteries, or in both. The gland-tissue proper may appear to be normal, or it may show the changes of degeneration or atrophy. In the reports of some cases of fat-necrosis it is stated that no lesion of the pancreas could be detected. In regard to the agency of the pancreas, or its secretions, in producing this lesion, experiments upon living animals have been tried by Langerhaus, Körte, Hildebrand, Williams, Flexner, and some others. These experiments consisted in injecting a fresh sterile pulp of the pancreas into the fatty tissue, or in transplanting a portion of the pancreas in the fat or inserting it into the peritoneal cavity, or in laceration of the pancreas *in situ* with ligation of the veins or duct. The results have not been uniform, but in a considerable number of cases fat-necrosis was produced. Flexner, in his experiments, demonstrated the presence of a fat-splitting ferment in the areas of fat-necrosis which resulted. These experiments have demonstrated how fat-necrosis may be produced, but it is not certain that they have demonstrated how it is produced. The question is too broad for discussion within the limits of this report.

Of the six cases recorded here, in three the fat-necrosis was confined to the interlobular and superficial fat of the pancreas, and was discovered at autopsy after death from other conditions. In the other three cases the fat-necrosis and hemorrhage were the principal lesions, and were the cause of death. It will be noticed that changes of a chronic nature were demonstrated in all of these cases, for the most part an interstitial fibrosis, more or less marked, with or without pronounced changes in the arteries. It will also be noticed that biliary calculi were found in three of these cases. From the frequent occurrence of gall-stones in these conditions it is very probable that the traumatism caused by the passage of a stone

through the common duct may be the portal through which minute lesions of the pancreas, hemorrhage, or fat-necrosis become infected, leading to suppuration or gangrene of the gland.

CASE II. *Cerebral Hemorrhage. Nephritis. Glycosuria. Disseminated Fat-necrosis.*

M. B., female; aged fifty; was brought to the hospital in the ambulance in deep coma, which continued until she died, six hours later. No previous history was obtained. Examination of the urine showed a considerable amount of glucose.

Autopsy, eighteen hours after death. Frame of medium size. Considerable fat on the abdominal wall, also in the omentum and mesentery. Muscular condition good. *Pericardium*, normal. *Heart*. Muscle rather flabby and pale. Aortic and mitral valves a little thickened. *Lungs*. Moderate congestion and œdema. *Gall-bladder*. Contains a calculus one inch long by three-fourths of an inch thick. *Liver*. Surface smooth and pale. Section pale and fatty. *Spleen*. Soft. *Kidneys*. Capsule not adherent. Surface smooth but showing a number of small cysts, one of them an inch in diameter. Cortex pale and opaque. Striations exaggerated in places. *Pancreas*. Surrounded by a large amount of fat. On the surface of the gland are seen numerous minute white spots, up to one-eighth of an inch in diameter. None is found in the omentum or mesentery. On section of the pancreas the lobules are seen to be widely separated by fat, and in this fat are found white spots similar to those on the surface but rather less numerous. If one of these spots is punctured a creamy substance can be expressed and the spot disappears. Weight of pancreas, two ounces. *Brain*. There is a mass of clotted blood occupying a large part of the left parietal and occipital lobes and part of the temporo-sphenoidal lobe. There is also a small pigmented scar, the result of an old hemorrhage, in the right internal capsule. The arteries of the body generally are moderately atheromatous. Microscopical examination of sections of the pancreas, hardened in four per cent. formalin solution and in alcohol, and stained with hematoxylin and eosin, showed some increase in the interlobular connective tissue, and islands of gland tissue separated by fat, in which were minute areas of fat-necrosis. The walls of some of the arteries were notably thickened.

CASE III. *Chronic Diffuse Nephritis. Alcoholism. Poisoning by Illuminating Gas. Burns of Buttocks. Disseminated Fat-necrosis in and around the Pancreas.*

T. B., male; aged forty-six; time-keeper; while intoxicated overturned a lighted gas-stove and was burned upon the buttocks and back, and partially asphyxiated by the escaping gas. He was brought to the hospital in the ambulance. The chief symptoms noted were prostration and apathy, increasing to semi-stupor; a considerable and increasing elevation of temperature; rapid and feeble pulse, and rapid respiration. Death occurred on the tenth day. The urine contained a moderate amount of albumin and a few granular casts.

Autopsy, eight hours after death. Frame of medium size. *Abdomen*. Prominent. Adipose abundant, especially on the abdominal wall. Muscular condition good. *Pericardium*, normal. *Heart*. Weight, eighteen ounces. Muscle flabby and pale. Valves normal. *Lungs*. Pleuræ normal. Atelectasis of both lower lobes. Some emphysema of upper lobes. Several small hemorrhagic infarctions in left lower lobe. *Peritoneum*, normal. Abundant omental and mesenteric fat. *Liver*. Surface smooth and pale. Consistence rather soft. On section, pale and fatty. Weight, seventy-eight ounces. *Gall-bladder*. Contains no calculi. *Pancreas*. Surrounded by abundant fat. In stripping off the fat several small cavities, filled with fluid resembling pus, are exposed. The largest of these is about half an inch in diameter and lies close to the head of the gland. Other similar spots of smaller size are seen on the surface of the pancreas, but most numerous about the head. Other spots are seen in the interior of the pancreas on the cut surfaces, also most numerous in the head. The material from the larger cavities has a gritty feel, and grates also under the knife. None of these spots is seen in the mesentery or omentum. *Kidneys*. Capsule moderately adherent. Surface uneven, rough, and granular, and presents several small cysts. Cortex rather thin and opaque. Striations irregular and indistinct. *Brain*. Firm; wet.

Microscopical Examination of Material from the Necrotic Cavities about the Head of the Pancreas.—Much granular matter, coarse and fine. Cells without nuclei, large and small; some filled with fat globules and some with granules. Abundant acicular crystals of minute size, single and in sheaves.

Sections of the pancreas showed marked increase of the interlobular connective tissue, apparently beginning in the walls of the ducts and spreading outward between the lobules and in places invading the lobules between the individual acini. Some small areas were infiltrated with blood, apparently freshly extravasated, while other areas showed scattered granules and masses of yellowish and brownish pigment, the result of former hemorrhages. Many minute areas of fat-necrosis, in different stages of degeneration, were seen, many of them with a zone of small cells around the periphery.

CASE IV. *Cardiac Hypertrophy and Dilatation. Thrombosis of the Right Subclavian and Iliac Veins. Hydrothorax. Hemorrhagic Infarctions of Lungs. Nephritis. Nutmeg Liver.*

N. A., male; aged thirty-nine. The patient gave a history of rheumatism and alcoholism.

The autopsy showed general atheroma of the arteries, together with the lesions mentioned above.

The pancreas was dotted on the surface and in the interlobular spaces with little yellowish-white spots which looked like fat-necrosis. Weight of pancreas, four and one-half ounces.

The microscope showed a number of small areas of necrosis of the superficial and interlobular fat of the pancreas. Around the periphery of some of those areas were many small cells. The tissue of the pancreas generally looked normal. In places, however, the interlobular connective tissue was moderately hypertrophied.

CASE V. *Pancreatic Hemorrhage. Fat-necrosis. Acute Peritonitis. Laparotomy.*

L. M., male; aged forty; gave a history of two previous attacks similar to the present one. These attacks were preceded by constipation and accompanied with epigastric pain and vomiting. No fever. The present attack began four days ago with constipation, severe epigastric pain, and vomiting. The vomitus at first was greenish fluid, and for the past day has had a fecal odor. The temperature at no time has been over 100.4° F.; pulse, 115; respiration, 30.

The respiration is thoracic. The abdomen is distended and tympanitic, and everywhere tender to pressure. The tenderness, how-

ever, is most marked just above and a little to the left of the umbilicus. No masses are felt.

Soon after the onset of the attack the patient had been taken to another hospital in this city, where a diagnosis of appendicitis was made. Operation was refused, and the patient was removed to his home. On the fourth day of his illness he was brought to the Presbyterian Hospital in the condition above described, the symptoms being those of general peritonitis. Influenced by the diagnosis made earlier, and in more favorable circumstances, an incision was made in the right inguinal region, and the appendix was found to be normal. The patient's condition did not warrant further exploration, and he died a few hours later.

Autopsy, seventeen hours *post-mortem*. Frame of good size; adipose considerable; condition of muscles good. *Peritoneum*. Much congestion. Slight fibrinous exudation. The surface is abundantly dotted with necrotic areas, from one-eighth of an inch up to one-half of an inch in diameter, mostly yellow, some brown, and generally firmer than the surrounding tissue; often slightly projecting. In the omentum, mesentery, appendices epiploicæ, and retroperitoneal fat are numerous similar necrotic spots, more on the left side, and some hemorrhagic areas, especially in the neighborhood of the pancreas. The *gall-bladder* contains a little thick greenish bile and numerous small yellow calculi. The *liver* is rather firm. The surface is roughened and presents numerous minute reddish depressed spots, the tissue between being pale yellow. The *spleen* is soft, but otherwise normal. The *pancreas* is almost entirely black, as if infiltrated with blood, and contains numerous pink, yellow, and brownish spots, some of them evidently areas of necrosis. *Kidneys*. The capsules are slightly adherent. The surfaces are smooth. The cortex is somewhat thickened and pale. The markings are indistinct in places and in places exaggerated.

Microscopical Examination of Sections of the Pancreas.—There are many areas of hyaline material of a yellowish-pink color suggesting blood. There is much granular matter, both fine and coarse, yellowish-brown and almost black in color, especially in the above-mentioned areas, where it is very coarse. The gland-tissue generally does not stain, except faintly, with eosin. Some of the gland-cells, however, stain clearly, but their arrangement is not regular. Some of the blood-vessels are filled with fibrin and some with red cells

and leucocytes. There is also blood in the interstices of the gland-tissue and in the fat. The walls of the arteries are markedly thickened, especially the intima, which is irregularly heaped up and in places very granular. In the fat of the pancreas and of the mesentery is seen a faintly blue-stained, finely granular material, some replacing part of the fat in single cells, and some replacing considerable areas of the adipose tissue. There is hemorrhage into and around these spots; also granules and spicules, some yellow and some dark brown. There are also inflammatory changes around these areas, a crowding together of leucocytes and proliferation of connective-tissue cells.

It would seem that in this case the endarteritis was the predisposing cause of the hemorrhage, and possibly of the fat-necrosis also. It is a well-known fact that endarteritis and atheroma may reach an extreme degree of development in some one artery or set of arteries, while elsewhere they are apparently only moderately developed. This fact may possibly explain many cases of chronic diffuse nephritis, which, at times, seems to be a local manifestation of general arterial changes. It is, hence, important to study *in loco* the condition of the arteries in pancreatic hemorrhage and necrosis.

CASE VI. *Pancreatic Hemorrhage. Fat-necrosis. Biliary Calculi.*

G., male; aged fifty; admitted March 13, 1896.

Previous history not obtained.

Present Illness.—The patient has had extremely severe attacks of abdominal pain for the past ten days, necessitating not only large doses of morphine, but also chloroform inhalations. The pain has been most severe about the umbilical region. The symptoms have been attributed to a calculus impacted in the common bile-duct. There has been no jaundice during the present attack or at any previous time. The patient is moderately corpulent.

The abdomen is not distended, and is fairly soft. There is moderate tenderness over an area six inches in diameter about the umbilicus. The bowels are moved by enema.

Operation. March 14.—The peritoneum is opened by an incision about one inch below the border of the ribs on the right side. There is a marked tendency of the intestines to protrude. The gall-bladder is in its normal position and is not distended. Several calculi are felt

in the gall-bladder, but none in the common or cystic ducts. The gall-bladder was opened and three calculi about the size of the finger-nail and several smaller ones the size of "duckshot" were removed. All of the calculi were round, smooth, and non-faceted.

Recovery from the anæsthetic was good. There was no vomiting and no distention of the abdomen. The severe pain, however, continued, and the patient was very restless. He gradually failed, and died three days later.

When the patient was admitted to the hospital his temperature was 100° F. On the day following the operation it rose to 101.5° F., and continued to rise until death.

An autopsy was not allowed. Examination through the operation-wound showed a hemorrhagic and necrotic mass surrounding the pancreas, and the pancreas infiltrated with blood. In the omentum and mesentery were many small areas of fat-necrosis.

Under the microscope these areas presented the characteristic appearance of fat-necrosis surrounded by small cell-infiltration. The record of the microscopical examination of the pancreas has been misplaced, and the only fact distinctly recalled is the presence of an interstitial fibrosis.

CASE VII.* *Retroperitoneal Fat-necrosis. Septic Peritonitis.*

K. H., female; aged twenty-six; was admitted to the hospital in March, 1896. She gave a history of several mild attacks of abdominal pain, but could not definitely state the location of the pain or the duration of the attacks. Three days before admission she was seized with severe abdominal pain, which at times was more acute in the epigastric region a little to the right side. Vomiting was almost constant. The bowels were not constipated. There was some fever and chilly sensations, but no distinct chill. When admitted the temperature was 101° F.; pulse, 140; respiration, 20. The patient was well-nourished and not anæmic. The expression of the face was anxious, and there was considerable dyspnœa. The heart and lungs were normal. The abdomen was considerably distended, especially in the lower part, and was generally tender to pressure; but the epigastric region and an area over the position of the

* A full account of this case was published by Dr. Eliot in the Medical and Surgical Report of the Presbyterian Hospital, Vol. II., January, 1897. A brief abstract of this report is here given

appendix were especially sensitive. The abdomen was also tympanitic and the muscles were rigid, but more so over the lower-portion.

An operation was advised and the appendix was removed by the usual incision. No pus was found, and the appendix was not appreciably diseased. The abdominal cavity was explored and a mass was felt in the position of the head of the pancreas, but larger than the normal size of that organ. Scattered through the omentum, which contained a large amount of fat, were numerous small granular bodies of the size of millet seeds, of firm consistency and whitish color. Some of these were removed for examination. There was no peritonitis. For a time the general condition of the patient was much improved after the operation, but she rather suddenly became worse, and died after twenty-three days.

Cultures from the abdominal cavity at the time of the operation showed abundant bacilli, resembling the *bacillus coli communis*. There were also some large cocci, probably from the air.

Under the microscope the appendix showed slight signs of inflammation in the outer coats, and the nodules in the omentum proved to be areas of fat-necrosis.

The autopsy showed the presence of general peritonitis. The intestines were matted together, and among them, scattered here and there, were small pockets of pus. In the omentum and mesentery were many small spots of disseminated fat-necrosis.

The pancreas was surrounded by a mass of necrotic tissue, evidently consisting of fat. The pancreas itself was firm and normal in size and appearance.

Under the microscope, however, sections of the pancreas showed marked increase in the interlobular connective tissue, and in places the intralobular connective tissue also was distinctly hypertrophied. Many areas of fat-necrosis were seen in the fat of the gland. No signs of hemorrhage or of suppuration were found.

The two remaining cases, one of retroperitoneal hemorrhage with gangrene of the duodenum, and the other a large abscess in the pancreatic region, have no discoverable connection with the pancreas, but on account of their retroperitoneal origin and close proximity to the pancreas, they are recorded here. In both of these cases gall-stones were present, and one of them gave a history of passing gall-stones in the stools. It seems reasonable to infer that a trau-

matism caused by the passage of a calculus through the bile-ducts was the starting-point of the lesion in both cases.

CASE VIII. *A Retroperitoneal and Abdominal Abscess of Unknown Origin.*

L. S., female; aged thirty-eight; was admitted to the hospital October 22, 1894.

Previous History.—Menstruation has been normal until recently. The patient has had two children, the last one twelve years ago; also one miscarriage nine years ago. The bowels have generally been constipated. For the past six years she has had attacks of "indigestion" at intervals of a few months. These attacks consisted of epigastric pain, followed by vomiting and flatulence, lasting but a few hours. There was also some jaundice. Her present illness began six weeks ago with pain in the epigastric region, followed by vomiting and flatulence. She was confined to bed and had chilly sensations and fever. At this time some plum-pits and several gall-stones were passed by rectum. Her stomach continued to be very irritable, so much so that since that time she has retained but little food. The abdominal distention increased and she passed quantities of gas per os and rectum. She has had only one attack of colic since her illness began, but she has become weaker on account of the vomiting.

On Admission.—The abdomen is distended, but less so than it has been. There is also some tenderness to pressure. The appetite is poor. The bowels are regular. There are no symptoms referable to the bladder or kidneys. Temperature, 102° F.; pulse, 138; respiration, 32.

Physical Examination.—The patient is poorly nourished and anæmic. The tongue is red and dry. The heart-action is rapid and feeble. The liver-dulness is obliterated. *Lungs.* Dulness over both bases behind. Subcrepitant râles and friction sounds are heard. *Abdomen.* Distended and tympanitic. Some irregular bogginess, but no tumors are felt. There is some general tenderness to pressure, but no place more sensitive than others.

The vomiting, flatulence, and pain in the abdomen continued and the patient became weaker. Stools involuntary.

On November 6, sixteen days after admission to the hospital, a median incision of the abdomen was made. A cadaveric odor was

emitted. Some adhesions were found in the right iliac fossa and were broken down. A little bloody pus was liberated. The appendix was removed.

The vomiting continued and the patient grew weaker and died four days later.

The appendix showed no evidence of inflammation on gross or microscopical examination.

Autopsy, twenty-two hours after death. Frame small; adipose considerable; muscle slight. *Pericardium* and *heart*, normal. *Left Lung*. Adhesions all over. Lower lobe much compressed. Mucopus in the bronchi. *Right Lung*. Posterior part congested and œdematous. The *gall-bladder* contains a large number of small, smooth, facettèd, pale-greenish calculi, and some yellowish-brown friable material. *Liver*. Surface adhesions; pale. The cut surface is pale and yellowish. *Spleen*. Rather tough. Gangrenous spots on inner side. Section rather pale. *Kidneys*. Capsule slightly adherent. Surface pale, with congested vessels. On section, the cortex is pale and yellowish. *Pancreas*. Firm; pigmented. *Stomach*. Mucous membrane a little thickened and irregular. Intestines are normal. The pelvic organs are normal. There is an enormous gangrenous cavity between the stomach and the transverse colon, and on the inner side of the spleen, below the left side of the diaphragm, and burrowing down behind the peritoneum on both sides of the vertebral column nearly to the brim of the pelvis, excavating the lumbar tissues on both sides, but especially the left.

CASE IX. *A Necrotic Suppurating Mass behind the Peritoneum of Obscure Origin.*

A. T., female; aged thirty-two; admitted March 13, 1895.

Family History.—Negative.

Previous Personal History.—Menses normal. Has had six children, the last one eleven months ago. Has not menstruated since. She has always been strong and healthy.

The present illness began nine days ago with sharp pains in the epigastric region. These have continued more or less constant with acute exacerbations lasting from ten to fifteen minutes and suddenly getting less. She has perspired profusely and has vomited everything taken into the stomach, also some greenish-yellow fluid; but no blood.

The bowels have moved daily either with or without enemata. There has been no jaundice. The urine has been highly colored, and on admission contains a trace of albumin, but no casts. Specific gravity, 1014. There is no blood and no pus.

Physical Examination.—The patient is poorly nourished and anæmic. The tongue is coated and the lips are covered with sordes. The odor of the breath is septic. *Heart.* Negative. *Lungs.* Dulness over both sides behind. Subcrepitant râles. *Liver.* Percusses small. *Abdomen.* There is marked fulness on the right side, just about the normal position of the lower border of the liver.

The whole abdomen is somewhat distended. On palpation a large tense mass is felt in the right hypochondrium, whether continuous with the liver or not cannot be determined. The tumor is about the size of a large cocoanut and is somewhat movable. It is very tender to pressure and gives an indistinct sense of fluctuation. Percussion over the mass gives marked dulness, almost flatness. Just inside of the tumor, under the ensiform cartilage, is the point of maximum tenderness and the point to which the pain is referred. The temperature is irregular and ranges from 100° to 104° F.

Operation was delayed for one week, during which time the symptoms continued without change. An incision was made over the tumor, along the outer border of the right rectus muscle. A thin-walled fluctuating mass was found behind the colon. This was incised and a large quantity of thin, bloody fluid escaped. No connection between the abscess and any of the surrounding organs could be found.

The pain and vomiting were not relieved by the operation, and the patient died within twenty-four hours.

Autopsy.—Frame of medium size; adipose slight; muscle good. *Heart.* The mitral valve admits only one finger. The flaps are thickened and rough, with some vegetations along the edges. The aortic valve also shows slight thickening and a few vegetations. The muscle appears thin, and the heart weighs eight ounces. The *lungs* are a little adherent at the base, and there is much congestion and œdema of the upper lobes. The *gall-bladder* contains thirty-one smooth, pale, rather firm, faceted calculi up to three-quarters of an inch in diameter. One calculus, three-quarters of an inch in diameter, is impacted in the beginning of the cystic duct. The cystic, hepatic, and common bile ducts are dilated, but no perforation is found. The *liver*

is soft and its surface is smooth and pale. On section it is yellow, with slight nutmeg markings, and appears to be fatty. The *spleen* is negative. *Kidneys*. Capsule free. Surface smooth and pale, showing congested spots. On section the cortex is pale yellow, with congested vessels. The stomach is much dilated and filled with dark-brown watery fluid. Behind the peritoneum, behind and to the right of the duodenum, is a mass six inches in longest diameter, mostly black, with many suppurating foci, in parts very soft and in other parts tough. It is contiguous with the head of the pancreas but does not invade that organ. The entire duodenum is intensely congested, and the greater part is gangrenous. The appearance of the mass is that of clotted blood and fibrin, more or less softened, and containing shreds of gangrenous fat. Microscopical examination of the pancreas showed a little degeneration of the cells in places. The kidneys showed a slight degree of chronic diffuse nephritis with chronic congestion. The mass behind the peritoneum was structureless and infiltrated with leucocytes. There was in it no evidence of new growth. The fluid removed by operation was mostly blood, the cells being largely degenerated and broken down. There were also some little clusters of fatty and granular leucocytes.

The common text-books of medicine and surgery pay little or no attention to the diseases described here, and we have to gather our data from monographs and the reports of isolated cases. Some of those consulted in the preparation of this report are the following :

- ATKINSON : Journal of the American Medical Association, 1895, vol. xxiv., p. 999.
 BALSER : Virchow's Archives, 1882, vol. 90.
 BRUCKMEYER : Inaugural Dissertation—Freiburg, 1896.
 CUTLER : Boston Medical and Surgical Journal, 1895, vol. cxxxii., p. 354.
 CHIARI : Prager Med. Woch., 1883, pp. 285, 299 ; Wiener Med. Woch., 1880, vol. xxx., p. 142.
 CASPERSON : Centralblatt für Chirurgie, 1894, No. 47, p. 1,163.
 DRAPER : Boston Medical and Surgical Journal, 1886, vol. cxv.
 FITZ : Middleton Goldsmith Lecture. Transactions of the New York Pathological Society, 1889.
 FLEXNER : Journal of Experimental Medicine, July, 1897.
 HAWKINS : Transactions of the Pathological Society, London, 1893, p. 78.
 KÖRTE : Semaine Medicale, April, 1895, p. 193 ; Berliner Klinik, 1896, Heft 102.
 LANGERHANS : Virchow's Archives, B. 90, p. 122.
 LE COUNT : Journal of the American Medical Association, 1896, vol. xxvi., p. 881.

MIDDLETON : Glasgow Medical Journal, 1894, vol. xlii., p. 99.

PONFICK : Virchow's Archives, B. 56, 1872.

PAUL : London Lancet, No. 3,712, p. 914.

ROLLESTON : Transactions of the Pathological Society, London, 1893.

SEITZ : Zeitschrift für Klinische Medicin, 1892, B. 20.

PROFESSOR LINDSAY STEVEN : Atti dell XI. Congresso Medico Internazionale
Rome, 1894, vol. 2, p. 193.

STOCKTON : American Journal of the Medical Sciences, 1895, n.s., vol. cx., p. 251.

THAYER : American Journal of the Medical Sciences, 1895, vol. cx., p. 396.

TRAFÖYER : Wiener Med. Woch., 1880, vol. xxx., p. 139.

WILLIAMS : Chicago Medical Record, 1896, vol. x., p. 37 ; Boston Medical and
Surgical Journal, 1897.

